Spring/Summer **2005**

USC Viterbi Engineer

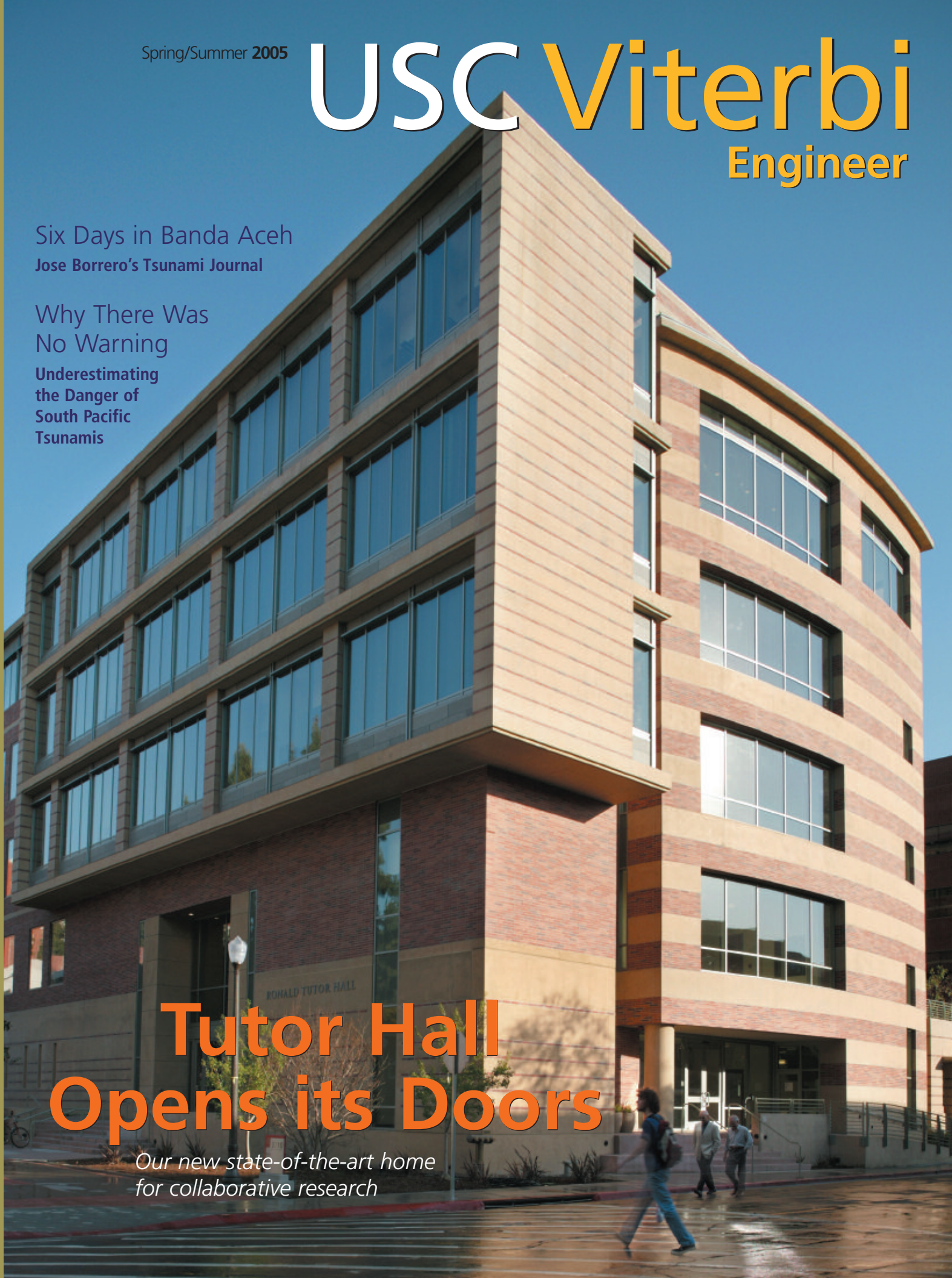
Published by the USC Viterbi School of Engineering for Alumni & Friends

Six Days in Banda Aceh

Jose Borrero's Tsunami Journal

Why There Was No Warning

Underestimating the Danger of South Pacific Tsunamis



Tutor Hall Opens its Doors

Our new state-of-the-art home for collaborative research

Volume 3 Issue 2

USC **Viterbi** School of Engineering

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USC Viterbi
School of Engineering

RONALD TUTOR and many other members of the Trojan Family have helped take the long-awaited Tutor Hall from the drawing board to the center of engineering innovation in the 21st century.

IT'S NOT TOO LATE TO JOIN THEM.

For a limited time, a special opportunity exists to permanently link your name to the Viterbi School's new home for undergraduate education and cutting-edge research.

New gifts and pledges of $25,000 or more, which can include company matching gifts, will be honored with named rooms and benches in and around Tutor Hall. Pledges can be paid over five years and will include concurrent membership in the USC Engineering Associates.

Please call 213/740-2502 to set up a tour of Ronald Tutor Hall and to learn more about this once-in-a-generation opportunity.

Ronald Tutor Hall Opens a New Era for the USC Viterbi School

Ron Tutor's passion for USC is now the new crown jewel of the USC Viterbi School of Engineering. Trojan engineers — past, present and future — will all benefit from the brand new and magnificent, 103,000 square-foot, six-story Ronald Tutor Hall.

Tutor Hall is the cover story of this issue of *USC Viterbi Engineer,* and you will learn much more about the building and the cutting-edge facilities contained inside for faculty and students. It has already become the social focal point of the Viterbi School. Students "hang out" at the Baum Family Student Center while the ground floor café with its adjacent airy courtyard is USC's new "in" place for lunch or a snack.

In this issue, you'll find a profile of the man behind Tutor Hall, Ron Tutor, who is a USC finance graduate and president and CEO of the construction giant, Tutor-Saliba Corp. He has built projects all over the world, but his heart has never left the Engineering Quad where he began his USC studies.

You can also read Jim Baum's moving address to students on the day that we opened Tutor Hall. Jim is the chair of the Viterbi School's Board of Councilors and we are very lucky to have a leader who never loses sight of the fact that we are all working for our students.

By now, you have probably heard that USC is celebrating its 125th anniversary this year. But did you know that this year also marks the 100th anniversary of engineering at USC? The first engineering courses, leading to professional civil and electrical engineering degrees were offered in the 1905/06 academic year. We will be celebrating this century of USC engineering later this year, especially October 6-9.

Elsewhere in this magazine is the announcement that I will become USC Provost beginning June 1. I am humbled by this assignment but also thrilled to have the opportunity to work alongside President Steven Sample, the most accomplished university leader in higher education today.

Many outside observers have noted that under Steve's leadership, USC has been on an upward trajectory. Instead of being satisfied, Steve believes, and I agree, that now is the time to redouble our efforts and accelerate our ascendancy to become an elite 21st century research university.

I am also happy to announce that Steve has selected Yannis Yortsos as the School's dean for an interim period. Yannis is currently the senior associate dean for academic affairs at the Viterbi School. I could not leave the School in more capable hands.

We are on the threshold of a great new era for Trojans, including Trojan engineers. For as USC rises ever faster, things will only get better for the USC Viterbi School. So, as I move to the post of Provost, I leave you with two words:

Fight on!

C. L. Max Nikias
Dean
USC Viterbi School of Engineering

Yannis Yortsos Named Dean for a Interim Period

For complete announcement, see page 4.

Nikias photo by Rich Marchewka, Yortsos photo by John Livzey

USC Viterbi
School of Engineering

Yannis Yortsos Named Dean for an Interim Period

Yannis C. Yortsos has been named dean for an interim period of the USC Viterbi School of Engineering by USC President Steven B. Sample.

"I have complete confidence in Yannis," said C. L. Max Nikias, current dean who will become USC provost on June 1. "Yannis has been at my side for the entire four years that I have been dean and he is intimately familiar with all of the Viterbi School's initiatives and other affairs."

Yortsos, a chemical engineer, has served as senior associate dean for academic affairs and oversees all faculty and academic affairs, both undergraduate and graduate.

"I am honored and humbled with this appointment. It is one of great responsibility and challenge" said Yortsos. "However, we have an experienced, energetic and confident leadership team in place and Max has built up a huge amount of momentum. We will continue the Viterbi School's spectacular ascent."

A national search for a permanent dean for the School will be formally launched immediately after Labor Day. As provost, Nikias will co-chair the search committee while President Sample will make the final decision.

Yortsos is the Chester F. Dolley Professor of Petroleum Engineering and a professor in chemical engineering. His is well known for his work on fluid flow, transport and reaction in porous media with applications to the recovery of subsurface fluids (oil recovery and soil remediation).

He earned a B.S. in chemical engineering from the National Technical University in Athens, Greece, in 1973 and his M.S. and Ph.D. in chemical engineering from Caltech in 1978. He, his wife Sheryl and their three children Chris, Katherine and Stephen live in San Marino.

Introducing... *USC Viterbi Engineer*

We are proud to premiere the new *USC Viterbi Engineer!* In this, our seventh issue, we are debuting the magazine's new name and a new look, both on the cover and throughout its pages. Since the School was named over a year ago, we have embarked upon an exciting journey to create and define the "Viterbi" identity and brand. This is just one more step toward fulfilling the great promise of the Viterbi name.

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We wish to acknowledge the following individuals for their contributions to this issue of *USC Viterbi Engineer:* Craig Rettig, Howard Schurman, Christina Koontz, Candace House, Phillip Sanfield, Carolyn J. Suckow, Jacqueline Williams, Christopher Noll, Paul Ledesma, Iraj Ershaghi, Barbara Myers, Rebecca Coleman, Isadora Gullov-Singh, Kirsten Strickland, Joyce Oo Mayne, Matthew Bates, Shawna Jones, Jason Dziegielewski, Talin Arisian, Ana Gamez, Anna Lisa Rodriguez and Jessica M. Bucciarelli.

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

Letters to the editor and comments are welcome. Please send them to: USC Viterbi Engineer, Olin Hall 300, Los Angeles, California 90089-1454, or email them to uscengineer@usc.edu.

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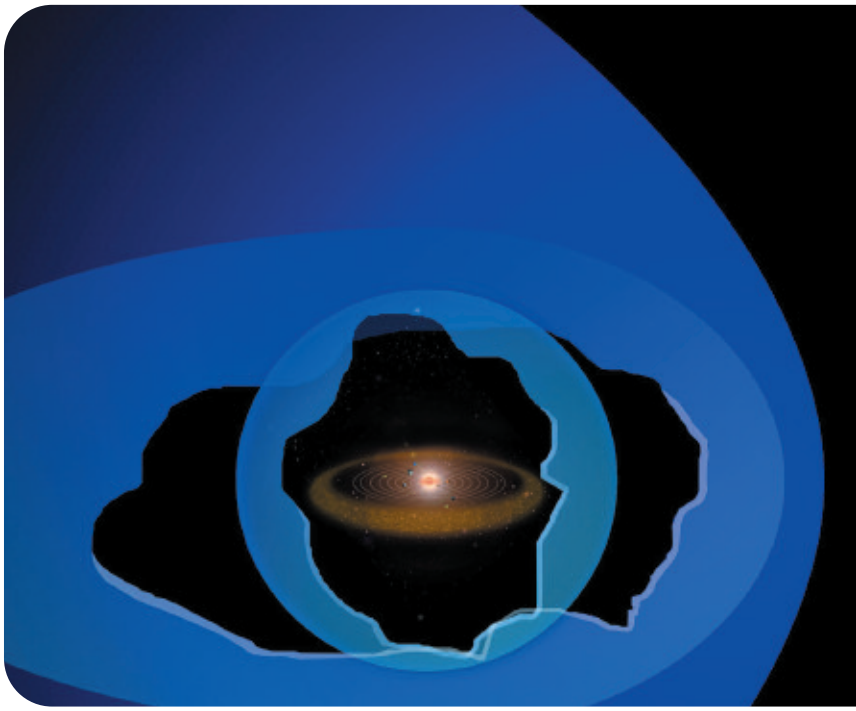
› STRAIGHT & to the POINT ‹

Journey to the Edge of the Solar System



Mike Gruntman's Interstellar Boundary Explorer (IBEX) will search for the heliosphere, a three-dimensional sphere (depicted in blue) enveloping the solar system and shielding it from interstellar space.

After 25 years of blood, sweat and tears, astronautics Professor Mike Gruntman finally has his wish: a chance to probe the very edges of our solar system with a spacecraft that can measure from afar the interactions of the solar wind with interstellar dust and gas.

Gruntman, who is chairman of the USC Viterbi School's Astronautics and Space Technology Division, is a co-investigator on the "Interstellar Boundary Explorer" (IBEX), a mission recently selected by NASA for development and launch in 2008.

IBEX will be the first mission to remotely sample the edge of the solar system, an uncharted region of space called the "heliopause," which is thought to lie about 10 billion to 14 billion miles from the Sun. This is the zone in which the Sun's powerful influence all but disappears and the solar wind drops from speeds of one million miles per hour to about 250,000 miles per hour.

Scientists believe an invisible "shock front" — called the termination shock — girdles the outer edge of the solar system at this distance. This plasma shock front is created in much the same way that an air shock forms in front of a supersonic aircraft as it flies through the air. The wave of plasma deflects ionized interstellar material and shields the solar system from harmful cosmic radiation streaming between the stars. Only two spacecraft in history have operated long enough in space to near that region — *Voyager 1* and *Voyager 2* — but neither carried the proper instruments to measure *in-situ* the properties of complicated flow patterns created when the solar wind collides with interstellar matter.

25 Years in the Making

Gruntman has been working on an interstellar mission to explore this tenuous boundary since 1983, when he published his first paper on the concept. His idea was to remotely probe the solar boundary by measuring fluxes of heliospheric energetic neutral atoms.

Along the way, advances in imaging technology brought his ideas into the realm of practicality and a team of scientists from several institutions came up with a new proposal. They suggested building a simple spinning spacecraft, endowed with a pair of large, ultra-sensitive cameras, to detect energetic neutral atoms produced at the solar system boundary.

The timing was just right. Many of the IBEX mission instrument requirements were ripe for development and successfully demonstrated on missions in the intervening years, including IMAGE, a satellite designed to image Earth's magnetosphere. IBEX builds on some of the technology flown on IMAGE. Once it begins to collect data, IBEX may also help scientists decipher any data they could receive from *Voyager 1*, the more likely of the two *Voyagers* to reach the termination shock.

The IBEX mission's science goals are central to NASA's Sun-Earth Connection program: to help scientists understand the connection between the Earth and the Sun, and more fundamentally, how the Sun and solar wind interact with the galaxy.

"IBEX will make the first global map of the boundary between the solar system and interstellar space, which is about 100 times farther away from the Sun than the Earth," Gruntman says. "Every four to five days, the spacecraft will travel outside of Earth's magnetosphere at the farthest point in its orbit and be able to study these neutral atoms

continued on next page

Journey to the Edge of the Solar System

continued from page 5

streaming from the edge of the solar system."

By getting clear of the Earth's magnetosphere, the spacecraft will be able to sense the energetic neutral atoms that have "ricocheted" back across millions of miles from the heliopause, or outer boundary of the solar system.

In the future, humanity will send spacecraft hurtling far past this planetary edge and into the galactic medium, which is dominated by stellar processes similar to those occurring at the edge of the solar system. Gruntman says if spacecraft are to survive their journeys into the galaxy, scientists must know what to expect.

Outbound To Other Stars

This is the first step, he contends, to a precursor mission for future space-faring vehicles that will be heading to very far-out places, like Alpha Centauri, our nearest star.

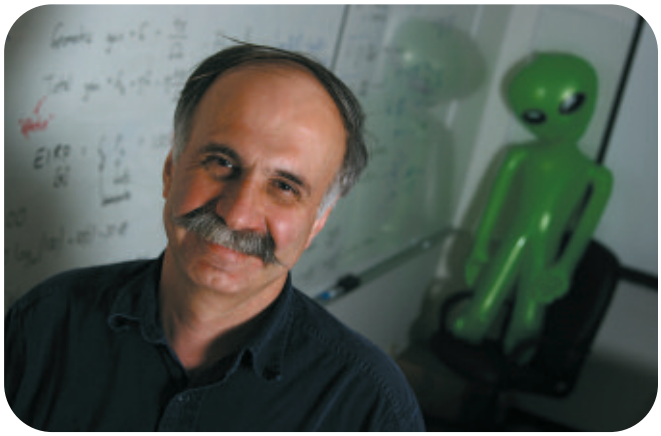
"Alpha Centauri is just 4.3 light years away," he says with matter-of-fact resolve. "It's not that far-fetched of an idea and it's not that far away. One day our starships will be going there."

Sound incredible?

Ask the IBEX science, hardware and management teams. For the next three years, they will be designing the cameras — two energetic neutral atom imagers — under the direction of mission principal investigator David McComas, a scientist at the Southwest Research Institute in San Antonio, Texas.

Orbital Sciences Corp. in Dulles, Virginia, will build the spacecraft, a lightweight design based on the company's MicroStar spacecraft design. Dozens of these spacecraft are already in orbit, performing communications and remote sensing missions. Launch from a Pegasus rocket will put the spacecraft into a highly elliptical orbit of about 150,000 miles above Earth — or about two-thirds of the distance from the Earth to the Moon.

The mission, which costs $134 million, is part of NASA's Small Explorer (SMEX) program of rapid, small and highly focused science exploration missions, which are designed to further scientific discoveries in astronomy and space physics. —*DA*



Mike Gruntman

Photo by Brian Morri

USC VITERBI SCHOOL FACULTY AND STUDENTS RECEIVE HONORS

MILIND TAMBE, associate professor of computer science, has been named the recipient of the ACM/SIGART Autonomous Agents Research Award. ACM/SIGART is the Association for Computing Machinery's Special Interest Group on Artificial Intelligence. The distinction is annually awarded to a researcher who has made exceptional contributions over the preceding five years to the discipline of artificial intelligence "agents"—computer programs that can perform autonomously when reacting to complex situations.

FIRDAUS E. UDWADIA, professor of aerospace and mechanical engineering, has been elected a fellow of the American Society of Mechanical Engineering. The grade of fellow is conferred upon an ASME member with at least 10 years of active engineering practice who has made significant contributions to the profession. Udwadia is also a professor of civil engineering, mathematics and information operations.

JENNIFER LYNN RUSSELL, a doctoral student in the Epstein Department of Industrial and Systems Engineering, is the 2005 recipient of the WTS' (Women in Transportation Seminar) highest academic award. She will receive a $6,000 Helene M. Overly Memorial Graduate Scholarship at the WTS National Conference in May in Scottsdale, Arizona. Russell is also a 2004 WTS-Los Angeles scholarship recipient and is a recent Eno Transportation Foundation Fellow who received the 2004 National Metropolitan Transportation Research Center's Student of the Year Award.

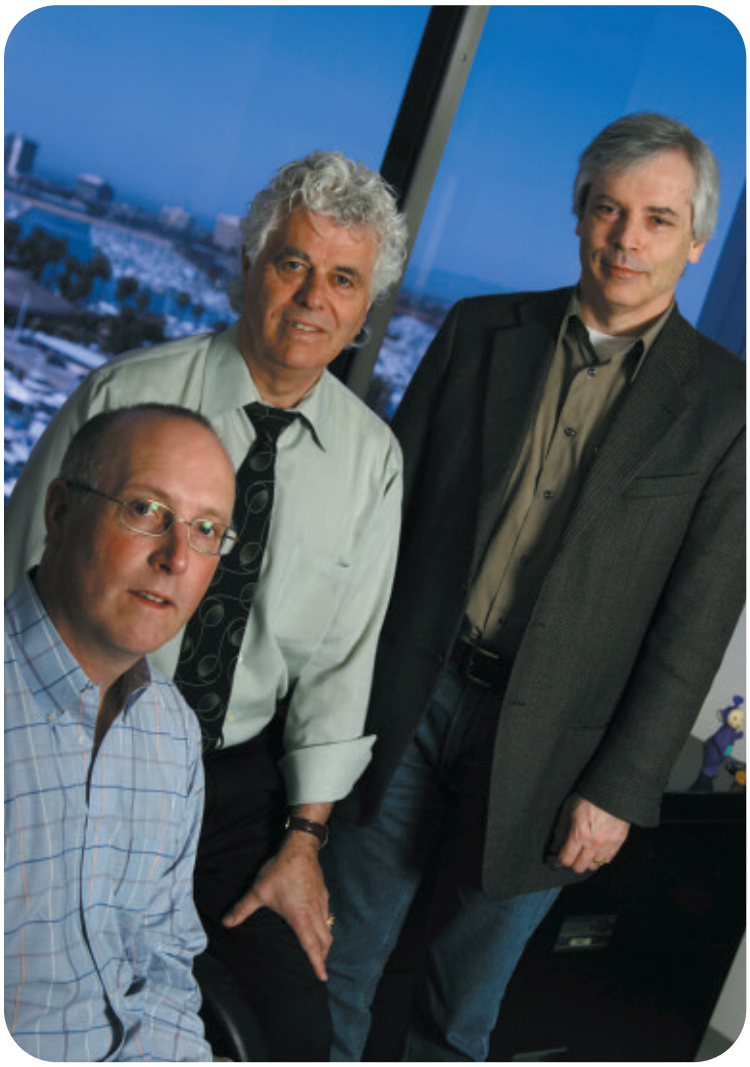
The Franklin Institute is honoring USC Viterbi School namesake **ANDREW J. VITERBI** (Ph.D. EE '62) with the Benjamin Franklin Medal in electrical engineering. The institute cites his algorithm used in cell phones, digital-image transmissions from space and other wireless communications as contributions of great impact to the field.

BEHROKH KHOSHNEVIS, professor of industrial and systems engineering, has been elected a Fellow of the Society for Modeling and Simulation. Fellows of the society must have demonstrated unusual professional distinction in the field of simulation and allied computer technology that is worthy of special recognition. The total number of fellows does not exceed more than 2% of the SCS membership. Khoshnevis is also the recipient of the 2005 Melvin R. Lohmann Medal. The Lohmann Medal honors a graduate of the College of Engineering, Architecture and Technology at Oklahoma State University who has made "outstanding technical or managerial contributions to his or her profession."

ISI Helps Form the Voting Systems Institute

Against a background of continuing controversy about the reliability, security and accuracy of voting technology, the Digital Government Research Center at the USC Viterbi School's Information Sciences Institute has collaborated with the Center for Governmental Studies to create the Voting Systems Institute (VSI).

The VSI will support a growing grassroots effort to develop objective test standards for tamperproof, verifiable and technologically sound voting systems and it will be a joint entity of both organizations.



James Dolbear, Tracy Westen, Yigal Arens

Photo by Brian Morri

The Center for Governmental Studies is a nonprofit, nonpartisan group with a 20-year track record of using technology to empower the underserved and improve communication between voters and candidates running for office. Funded by the National Science Foundation and other agencies, the Digital Government Research Center is a joint enterprise of USC and Columbia University, with a charter to use digital technology to improve government efficiency and public access.

VSI will work closely with a coalition of state and county election officials, computer and security experts, and voting equipment manufacturers who are creating assessment methods for voting systems. The coalition is known as Voting Systems Performance Rating or VSPR.

Tracy Westen, chief executive officer of the Center for Governmental Studies, says that their "aim is to improve confidence in U.S. election systems by providing an open and objective basis for rating them."

Advocates and election officials can use the coalition's voting system assessments during purchasing decisions, Westen explains. "We expect over time that VSPR will create a framework for innovation that will ultimately lead to increased voter confidence and civic participation."

Yigal Arens, co-director of the Digital Government Research Center and a division director at ISI, noted that Voting Systems Performance Rating is modeled on the highly successful Internet Engineering Task Force, the unincorporated entity responsible for developing the standards that make the Internet work.

DGRC
DIGITAL GOVERNMENT RESEARCH CENTER

"We believe that VSI can introduce the same open, democratic methods for voting systems that succeeded brilliantly in creating workable and universally accepted standards for the Internet," Arens says, adding that the new Voting Systems Institute will be able to facilitate efforts by helping provide access to academic expertise and, potentially, research funding.

He added that ISI was deeply involved in the Internet Engineering Task Force, "and we understand how to help build consensus among different parties from our previous work there."

Arens and Westen say that the Voting Systems Institute will be headed by James Dolbear, who has previously founded and run technology associations and has researched voting developments extensively over the last several years.

Dolbear recounts that in the wake of problems with punch-card systems in Florida, the "Help America Vote Act of 2002" provided funding to replace voting systems, and as a result state and local election officials initiated a wide range of reforms while vendors introduced new voting equipment.

"But progress has been tempered by continuing security concerns," Dolbear says. "And coming out of the November elections, absentee voting, provisional voting and registration have been highlighted as potential issues."

He says that Voting Systems Performance Rating offered a way to bring together all parties to structure and define the relevant technical aspects of voting systems.

"We are embracing VSI as a natural outgrowth of our community building role in digital government," Arens says.

For more information please visit http://www.votinginstitute.org/

A Colossal Oil Refinery

Viterbi Engineer Unravels Secrets of Titan and Saturn's Rings

Smoggy Titan, a moon of Saturn almost the size of Mars, has kept its secrets well hidden beneath a soupy mix of brownish-orange haze. But four close encounters by the *Cassini* spacecraft have changed all of that.

In an unprecedented first look into the moon's mucky atmosphere, Donald Shemansky, professor of aerospace and mechanical engineering in the Viterbi School and a co-investigator on the Cassini Ultraviolet Imaging Spectrograph (UVIS) team, has begun to measure the temperature structure and composition of Titan's thick cloud cover. Titan's haze extends hundreds of miles above its surface and is so thick that it blocks sunlight from reaching the moon's surface.

Shemansky says Titan's atmosphere is made up of roughly 95 percent nitrogen and 3 percent methane, but the air also contains a variety of carbon-hydrogen compounds, called "hydrocarbons," which create thick lower layers of atmospheric haze. That rich organic soup covers Titan in a gooey mud of methane, ethane, acetylene and propane — what on Earth would be considered one colossal oil refinery. If oxygen were present, Titan's air would ignite with the stroke of a match.

New ultraviolet data from Shemansky's instrument — the first close-range data ever gathered of Titan's opaque atmosphere — reveals a moon that is locked in a deep freeze of primordial ingredients that formed with Titan billions of years ago. The UV imagers are able to determine the composition, distribution, aerosol content and temperatures of Titan's atmosphere from the stratosphere, 10 miles up, to the thermosphere, about 180 miles up, at which point the UV instrument's transmission is blocked by haze. Shemansky and his imaging team will publish the results of their look at Titan's atmosphere in the June 2005 issue of *Science* magazine.

It's just the beginning of *Cassini's* flights past the giant moon — with 40 more Titan encounters to go — but the scientific payoff this early in the mission has been tremendous, Shemansky says.

An Oddball Moon

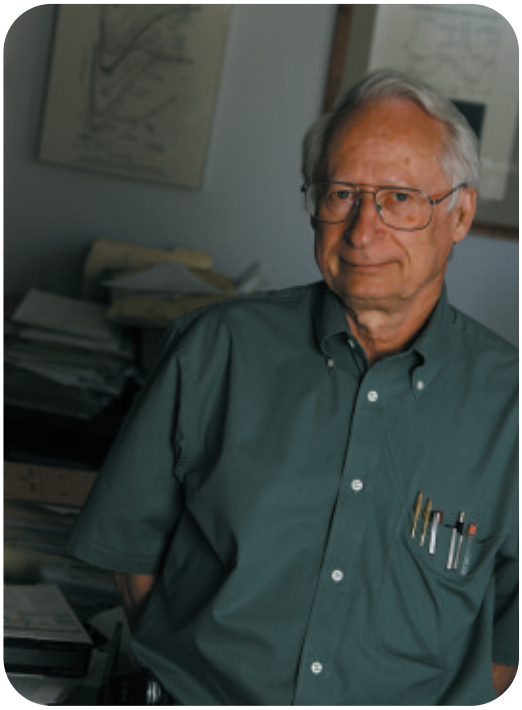
Titan, the second largest moon in the solar system, is something of an oddball. Its surface pressure is about 50 percent greater than the atmospheric pressure at sea level on Earth.

Like Earth, its atmosphere is predominately nitrogen. Much of it probably came from ammonia, a compound of nitrogen and hydrogen that is quite common in the outer solar system, Shemansky says. Ammonia is easily broken into hydrogen and nitrogen atoms by the Sun's ultraviolet radiation. But because Titan's gravity is too weak to retain hydrogen atoms, these atoms escape into space and leave the more massive nitrogen atoms behind.

The second most abundant gas on Titan is methane, which is the principal component of the "natural gas" used on Earth as fuel. The gas constitutes about five percent of the atmosphere near Titan's surface, according to the latest data from Shemansky's team. As it mixes with other molecules at higher altitudes, it separates into novel subspecies, called "dissociation products," which interact with nitrogen atoms to form "nitriles," such as hydrogen cyanide. These radical hydrocarbons polymerize and form the aerosol haze that is seen at altitudes up to and above 600 kilometers (372 miles).

At 372 miles above the surface, all of the chemical changes in the atmosphere seem to cease, Shemansky reports. Solar extreme ultraviolet (EUV) radiation does not reach any farther down or mix to produce radical hydrocarbons. Organic soot drifting down from the upper atmosphere will eventually accumulate in a thick bottom layer of haze.

Scientists thought the *Cassini-Huygens* probe, which landed with a "splat" on Titan's surface Jan. 14, would break through that haze at about 72 kilometers (45 miles) above the surface, but they were surprised. The probe did not break through the haze until it was 32 kilometers (20 miles) above ground. Then it encountered methane clouds at about 16 kilometers (10 miles) above the surface. Below that, the probe found a dark, rocky landscape washed clean by methane showers and soaked in pools of standing liquid.



Donald Shemansky

Ingredients for Life

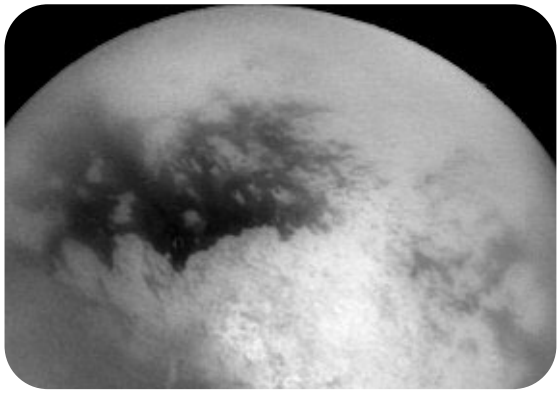
Taken together, the data suggests Titan has all of the organic molecules that were present in the chain of chemistry that led to life on Earth. But there are differences that precluded life from taking hold on a moon so far away from the Sun.

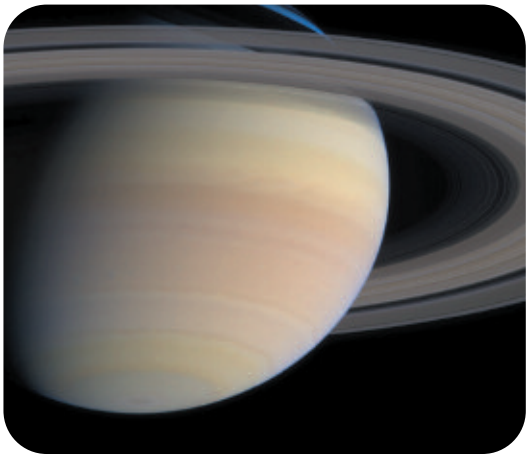
"Titan's too cold and it can't support liquid water," says Shemansky, who analyzes UV spectra in his second-floor USC office in Rapp Engineering Laboratory. "Sunlight doesn't reach Titan's surface, so daytime would be about as bright as a moonlit night on Earth. The surface is never warmed as it is on Earth; ground temperatures average –175 degrees Celsius (-283 degrees Fahrenheit)."

Lifeless as it may be, Titan's intricate chemistry produces methane showers. On Earth, methane exists as a gas, but in very cold climates, methane can exist as a liquid or be frozen into ice. That explains Titan's tar-like permafrost and possible oceans of liquid methane.

Radar images taken by the 705-pound Huygens probe as it parachuted through Titan's atmosphere revealed icy highlands "washed bare by methane rain." The rain could be

Shemansky photo by Brian Morri





Left; Cassini saw fewer clouds over Titan's south pole on its third flyby in February 2005 than it did in previous flybys. This mosaic of images was taken from a distance of about 140,000-150,000 miles from Titan. Right; Saturn

carving channels and emptying into vast floodplains, where the methane gradually seeps back into the ground, European Space Agency scientists say. Examining data from the probe, they also reported seeing "cryovolcanic" features, most likely produced by eruptions of melted water mixed with ammonia.

Like many of his colleagues, Shemansky remains guarded about the interpretations and processes that have shaped Titan's surface. It's been 25 years since the *Voyager 1* spacecraft first attempted to peer into Titan's opaque womb of clouds. Shemansky knows it will take many more years to understand the thermal structure of Titan's atmosphere, which influences conditions on its surface. Right now, Titan's atmosphere seems to be unlike anything found on Earth.

No Warming Effect on Titan

"Different atmospheric constituents (species) cause the radiative cooling process on Titan and haze prevents solar radiation from reaching the surface, so clearly, we are not dealing with an Earth-like environment," says Shemansky. "Heating of the air on Earth is controlled at the surface by convective transfer, as the air comes in contact with the ground and radiates back up. That gives us a warming effect that isn't present on Titan."

Another key difference lies in the "mesopause," a level of Earth's upper atmosphere at an altitude of about 90 kilometers (56 miles), above which temperatures rise as altitude increases, instead of falling as they do in the lower atmosphere. On Earth, heating occurs in this layer from oxygen interactions with solar radiation. On Titan, the heating is controlled mainly by molecular nitrogen interactions with UV light.

"The differences are striking," Shemansky says. "The temperature in Titan's mesopause is 114 Kelvin (-254 degrees Fahrenheit), almost the same as we find in Earth's mesopause, but at a much higher altitude of 615 kilometers (381 miles) above Titan's surface. The warming is occurring much higher up."

Mysteries also surround the source of Titan's nitrogen. No one really knows where it came from. Did molecular nitrogen accumulate as Titan formed or is it a byproduct of the ammonia that formed with Titan? Perhaps it came from comets.

Shemansky says it is too soon to tell. "I don't think we really know yet what is going on in Titan's atmosphere, or on the surface, for that matter," he admits.

Not the Only Mystery

Titan's alien atmosphere isn't the only riddle keeping scientists busy. As the spacecraft flew through Saturn's sparkling necklace of icy rings and entered orbit last July, the planet let loose with a massive eruption of atomic oxygen way out in the outer rings. UV data indicated that about 275 million pounds (125 million kilograms) of oxygen was abruptly released in a short period of time.

"That was our first surprise in the ultraviolet," says Shemansky, who continues to analyze the data along with Janet Hallett, a postdoctoral aerospace research associate. The huge oxygen burst may be an indication that Saturn's wispy E ring is eroding so fast that it could disappear within 100 million years if not replenished.

"We aren't sure yet whether this was a transient event or part of a routine recycling process in Saturn's magnetosphere," Shemansky says. "Right now scientists are speculating that the oxygen eruption may have been caused by a collision of ice particles from the planet's distant E ring with material in one of the main ring systems, A, B or C. Or it could have been a meteorite collision or an eruption of icy slush on Enceladus, a moon that orbits in the E ring."

The observations suggest that Saturn's placid appearance from Earth is anything but that. On the contrary, Saturn commands a dynamic world of complex, braided ice rings, cannibalistic moons, 1,100 mile-per-hour planetary winds and electrifying auroral displays high in the night skies.

The planet, its moons and highly structured rings live inside a huge cavity in the solar wind created by the planet's strong magnetic field. The magnetosphere is a bubble of particles including electrons, various species of ions, neutral atoms and molecules, several populations of very energetic charged particles like those found in Earth's Van Allen Belts, and charged dust grains. These ionized (electrically charged) gases are called plasmas. However, unlike Jupiter's magnetosphere, Shemansky says Saturn's magnetic cocoon is smaller and filled primarily with neutral gas rather than ions.

"Saturn's magnetosphere is turning out to be very different from Jupiter's," he says. "It's dominated by neutral gas and water-rich ingredients produced by its rings, as icy moon debris collides or by the more energetic collisions of incoming meteorites. It doesn't have nearly as many charged particles, and many of them are absorbed by the rings, so the plasma processes we are observing are entirely different." —*DA*

The Chip Pay Off

Melvin A. Breuer and S. K. Gupta

Photo by Brian Morri

Computer chip manufacturers traditionally have had a single, simple standard for their product: perfection. But a USC engineer who has spent his career devising ways to have chips test themselves has found that less than perfect is often good enough — maybe good enough to save billions of dollars.

"Chips with any flaws at all have always been discarded," says Melvin A. Breuer, a professor in the Viterbi School department of electrical engineering. "And this significantly increases the cost for the good ones."

When manufacturers start making a complex chip, a very large percentage of the new chips are faulty, Breuer explains. He says that the percentage goes down as manufacturing techniques improve but "by the time the technique is thoroughly mastered, the chip is on its way to being obsolete."

Some chip designers try to cut their losses by designing redundancy into the circuits, so that when circuitry fails, other circuitry can take its place. Even with these measures, which also raise costs, large numbers of chips wind up as expensive industrial waste.

Traditionally, the wastage — often half the output or more — is written off as a business cost. But are all faulty chips useless? Seven years ago, Breuer and Viterbi School colleague S. K. Gupta began investigating the idea of acceptable errors produced by defective chips.

For some applications — security, accounting and scientific applications — errors are intolerable, says Breuer. But for many others, including graphics, there is a surprising amount of leeway for "error tolerance."

"If you have an application where the end user is a person, rather than another computer, small changes in the output are imperceptible," says the researcher. For example, images created by a chip with a few defects might cause one or two pixels to be out of place.

The critical factor, Breuer says, is the ability to economically test and accurately predict if a defective chip will provide acceptable performance without having to plug it into the application. Breuer and Gupta have developed simple built-in test structures for chips that can automatically determine attributes regarding their erroneous performance, such as error rate and significance.

Breuer specializes in problems like these. He is the author of several books on the subject including *Diagnosis and Reliable Design of Digital Systems* and *Digital System Testing and Testable Design.* He is also on the editorial board of the *Journal of Electronic Testing.*

In a 2004 paper in *IEEE Design and Test Magazine,* Breuer, Gupta and Intel Corp. Senior Staff Engineer T.M. Mak were able to set forth a framework to analyze errors and predict usability. One such analysis indicated that 60 percent of chips with a single defect would nevertheless be able to decode MPEG video files and play them back with no noticeable errors for users.

Because of this and other work, the National Science Foundation recently awarded $1.1 million to Breuer, Gupta and two other Viterbi School researchers, Antonio Ortega and Keith Chugg, to investigate and develop error tolerance. Breuer and Gupta have also received funding for this work from the Semiconductor Research Corporation, and Breuer has received additional funding from the Okawa Foundation.

Ortega and his students in the Viterbi School's Signal and Image Processing Institute have already created simulations of images produced by flawed chips implementing JPEG and MPEG encoding operations, and the results confirm that a significant fraction of the flawed chips produced only slightly degraded performance which was unrecognized by the viewer. This group is also looking into additional applications for imperfect hardware.

Chugg and his students in the Viterbi School Communication Sciences Institute have demonstrated that turbo decoding chips, which are being adopted for next generation wireless communication systems, are very robust to circuit defects. In fact, such chips can have a significant number of defects in the memory circuitry with little or no perceptible degradation in performance.

Industry is also starting to prick up its ears, says Breuer. "When I first started talking to them," he recalls, "they were very negative. 'We don't want our name associated in any way with defective product,' was their response." But their attitude seems to be changing. Breuer says that over the last 12 months he has been invited to give "keynote" talks at three conferences on the subject of error tolerance.

"If these ideas catch on, we will see a major paradigm shift in the way chips are designed, tested and marketed. And these ideas will allow industry to continue to scale technology according to Moore's law, while reducing the

cost of chips to the end user," Breuer notes. He adds that "considering that the net revenues of chips sold in 2004 was over $210 billion, the annual economic impact of these ideas could easily amount to billions of dollars."

Mak, who was Breuer's co-author on the 2004 paper, admits he was skeptical at first. His skepticism grew out of earlier experience, with chips combining two functions. "If one of the elements of the chip didn't work, we thought, we could still use the other."

But Mak says this decision created logistical problems because the supply of half-usable chips was so unpredictable. Intel ended up shipping many chips that had no defects to customers who were paying a lower price for imperfect chips.

As trends in chip manufacturing lead to denser and denser architectures, producing more and more manufacturing flaws, it becomes increasingly difficult to ship chips that meet the perfection standard.

Mak says that Breuer's testing approach means that an elegant and workable solution might be possible for the logistical problems experienced before. "I'm eager to see what he comes up with," Mak says.

As a further indication of interests in these ideas, one chip manufacturer has given the Viterbi School a batch of 1000 defective chips for analysis and testing of usability-prediction algorithms.

"We don't have people going through chip manufacturer's dumpsters yet, looking for usable silicon, but we've just started working," Breuer says. —*EM*

In the News *Coverage of USC Viterbi School Faculty and Projects*

The ***Wall Street Journal*** quoted computer scientist **Ulrich Neumann** about the use of "augmented reality" to enhance stories. "To open a book and see this animation happen is counter to anyone's experience," Neumann said. "This is not to replace the imagination, but to help it along a bit."… ***Foreign Policy*** reported that the Information Sciences Institute and the Defense Advanced Research Projects Agency have teamed up to produce a virtual reality simulation to help soldiers become more culturally sensitive in Iraq… The ***Chronicle of Higher Education*** reported that Viterbi School namesake **Andrew J. Viterbi** was awarded the Benjamin Franklin Medal in electrical engineering *(see story on page 14)* by the Franklin Institute Committee on Science and Arts… ***Wired*** magazine reported on electrical engineer **Melvin Breuer's** research suggesting that millions of dollars could be saved by not discarding slightly imperfect chips *(see story on page 10).* "The bottom line is these guys are throwing away half their product," Breuer says about chip manufacturers. "It would be nice if they could salvage some of this."

In March, the ***Los Angeles Times*** reported on a project headed by **Martin Gundersen** to create a more realistic portrayal of science in movies. Last year, Gundersen ran a two-day screenplay workshop for 14 scientists at the American Film Institute; he said he hopes at the very least that workshop graduates will develop second careers as science consultants… The ***Los Angeles Times*** also quoted **Alfred Dickinson**, director of the School's Aviation Safety and Security Program, in a story about an improved safety record in the private jet aviation industry.

The ***Chronicle of Higher Education*** quoted **Randolph Hall**, co-director of the Center for Risk and Economic Analysis of Terrorism Events (CREATE), in a story about the popularity of new homeland security programs on campuses. "You have to deliver the education where the students need it and when they need it," he said describing USC's online master's degree program in homeland security… In the ***Wall Street Journal***, Hall discussed the benefits of a new sonar device able to differentiate between human divers and underwater life. The ***Associated Press*** sent the story around the country, and it was picked up widely, including by ***The New York Times***. Hall had previously been interviewed on ***CNN's*** "Newsnight with Aaron Brown" about port safety… The ***Los Angeles Daily News*** mentioned CREATE in a story about Cal State Northridge's plan to deal with a terrorist attack. The **Daily Trojan** also covered a CREATE conference on reducing the risks and consequences of terrorism. Media outlets that attended included the ***Los Angeles Times***, ***United Press International***, ***City News Service***, ***KQED-FM***, ***Fox 11 News***, ***KSCI-TV***, ***KFWB-AM***, and ***Metro Network News***.

The ***Los Angeles Daily News*** quoted **Henry Koffman**, director of the Construction Engineering Program, in a story about the costs for cleanup of the Belmont Learning Center site. Koffman said an easy engineering solution "got blown up... The people who got hurt the most are the kids."

In the wake of January's tragic Metrolink accident, transportation engineer **James Moore** wrote an op-ed article in the ***Los Angeles Daily News*** about making Metrolink and other trains safer. "We should saturate the freight rail network with electronic surveillance... Rails should be retrofitted with sensors to detect breaks or the presence of large metal obstructions. Every foot of track should be subject to video surveillance," Moore wrote. Moore and **Najm Meshkati**, a safety expert, were quoted in numerous newspaper stories and were on many TV and radio broadcasts. Some of the media included ***CBS News*** "***The Early Show***," ***Glendale News-Press***, ***Los Angeles Times***, ***Ventura County Star***, ***KPCC-FM*** "***AirTalk***," ***KCRW-FM*** "***Which Way, LA?***", ***KNX-AM*** and ***KCBS-TV***…The same week of the train accident, Meshkati was also a guest on ***KPCC-FM*** "***AirTalk***" to discuss Iran's nuclear programs, and the ***Press-Enterprise*** later quoted Meshkati in

continued on page 12

In the News *continued from page 11*

a story about a 14-year-old boy who caused three freight trains to derail…Meshkati was also interviewed by ***CNN International*** about the 20-year anniversary of a deadly gas leak in Bhopal, India. Meshkati said the "lack of human or organizational factors," such as poor training and inadequate emergency response procedures, contributed to the accidents in Bhopal and Chernobyl.

ComputerWorld quoted computer scientist and graphics whiz **Paul Debevec** in a story about the computer technologies the U.S. military is using to train soldiers for urban warfare. "In the past few years, PC graphics cards have advanced to capabilities beyond expensive simulation engines," he said…***Wired News*** interviewed **Albert "Skip" Rizzo** about his computer simulation project to help Iraq War veterans with post-traumatic stress disorder…***InformationWeek*** mentioned grid computing guru **Carl Kesselman** in a story about the formation of the Globus Consortium *(see story on page 20),* which he co-founded to promote grid-computing software for businesses. ***Network World*** quoted Kesselman in a story about a new product that consolidates different types of files, storage devices and servers into a common device. "The idea of consolidating the devices so they are easier to administer appealed to us," Kesselman said.

CNN's Paula Zahn interviewed cyber-security expert **Cliff Neuman** about private citizens who use the Internet to track potential terrorists, while the Australian edition of ***ComputerWorld*** quoted him about the security needed for grid computing systems…The ***Chronicle of Higher Education*** reported on **Donald Shemansky's** NASA study, which looked at the chances of Saturn's rings disappearing within 100 million years. "The implication is that the ring system is recent, in the sense of 100 million years as being recent," said Shemansky. The study was also featured in the ***New York Times*** and ***Space.com***…The ***Chronicle of Higher Education*** also took note of the $22 million gift made by Silicon Valley venture capitalist and USC trustee **Mark A. Stevens** (BSEE '81, MSCE '84) and his wife **Mary**…The ***Los Angeles Times*** featured the house-building robot invented by **Behrokh Khoshnevis**. He said that as soon as 2025, the contour crafting technology could become a construction industry mainstay.

An ***Associated Press*** story about video-game-based training simulators created at the Institute for Creative Technologies (ICT) noted that the Army contract had been extended for an additional five years and $100 million. USC Viterbi faculty and ICT deputy director **Randall Hill** said the programs are "all about cognitive training and decision-making under stress." The ***Associated Press*** story was carried widely around the nation, including in the ***New York Times***…***Time Magazine*** quoted **Dean C. L. Max Nikias** about how some 200 colleges and universities now offer homeland-security studies. "A lot of companies are specializing in homeland-security technology," Nikias said. "Everybody wants to get into this." USC's online master's degree in system safety and security was also mentioned.

The ***Orange County Register*** and the ***Los Angeles Times*** ran stories on the Quick! Help for Meals program *(see story in USC Engineer Fall/Winter 2004 issue)* developed by the Information Sciences Institute with the Keck and Annenberg Schools. The program uses custom software to generate personalized recipe booklets to increase the amount of fresh produce consumed by low-income people who utilize food pantries…The ***New York Times*** featured a story on a gunshot-detection system based on work by **Theodore Berger** *(see story on page 16).* Berger, director of the Center for Neural Engineering, said the Smart Sensor Enabled Neural Threat Recognition and Identification, or the Sentri system, is able to distinguish gunshots from voices, car traffic, and construction. Berger was also quoted in ***Wired*** about gunshot-detection devices installed in Chicago and several other cities. "You can see it as having a robotic policeman on the street," said Berger, who helped develop the devices for Safety Dynamics.

The Guardian mentioned **Costas Synolakis** in a story about a plan to build an underground pipe to extract gas in Peru. At an American Geophysical meeting, Synolakis and his colleagues said Peru is overdue for a massive tsunami…***The Age*** quoted **Michael Arbib** in a story about a Japanese scientist who is studying speech development in monkeys in order to better understand how language emerged in humans. Arbib said the monkey call system seems to be much more "flexible" than previously thought…The ***Baltimore Sun*** quoted **George Bekey** about a plan to use robotic technology to repair the Hubble Space Telescope.

The Godiva process-in-memory chip designed at the Information Sciences Institute was featured in ***Newsfactor Network*** *(see story in USC Engineer Fall/Winter 2004 issue).* ISI's **Jeffrey Draper** said that "a PIM chip can keep results and data in its own memory, resulting in dramatic gains in speed." Colleague **Mary Hall** added that "we will deliver eight times the computing power using less than one tenth of the electricity." …The ***Baltimore Sun*** mentioned a laugh synthesizer being developed by doctoral student **Shiva Sundaram** in an article about efforts to develop expressive speech synthesis in computers. "Laughter is a very, very complex process," Sundaram said…***Reuters*** quoted **Hannes Vilhjalmsson** of ISI in a story about video games that help train firefighters, police officers and soldiers. "Instead of shooting people, you're talking to them and trying to win their trust," said Vilhjalmsson, who helped develop the Rapid Tactical Language Training System.

Thinking Small

New Center Will Build Next Generation "Microsatellites"

The USC Viterbi School of Engineering has formed a new center to work with local aerospace companies to design, build and launch a new, smaller and less expensive class of satellites. The USC Microsatellite Systems Center will also develop new education and training programs in space and astronautics technologies.

"The aerospace industry currently has a critical shortage of young engineers trained in astronautics and space," says Viterbi School Dean C. L. Max Nikias. "We believe this center will nurture new engineering talent and allow Southern California to seize the opportunity to become a world center for microsatellites."

Typically, even "small" satellites today tip the scales at 400 kilograms (880 pounds). These complex satellites are usually built by governments and are relatively inflexible in regard to uses.

Microsatellites is an exciting domain because the development of new miniaturization technology driven by consumer technology gives the possibility of much less expensive but still highly performant satellites and payloads," says Peter Will, an award winning robotics researcher and Fellow at the Viterbi School's Information Sciences Institute (ISI) in Marina Del Rey. He will direct the new center in partnership with the School's Astronautics and Space Technology Division at USC.

"We think that space research and exploration needs the equivalent of the personal computer — small, relatively cheap, highly flexible vehicles," says Will. "This will greatly expand the use of space."

According to Will, microsatellites will weigh in at about 100 kg (220 pounds) or less. They will be capable of a range of tasks from earth imaging, communications, asset and people tracking through applications in space science.

Microsatellites are particularly promising for applications that require maneuverability, he says. Applications that require large physical size — antennas, for example — could be handled like constellations; several microsatellites that assemble themselves into larger units.

Will said that the scientific challenges involved in the creation of such vehicles require teams with a broad range of expertise, including astronautics, propulsion, space instruments, on-board computation, control, computer aided design, spacecraft construction, radiation hardening, communications and networking. We already have large pieces of these scientific disciplines in place at USC," he says. "In addition, Los Angeles is rich in resources, both academic and industrial, in the relevant categories."

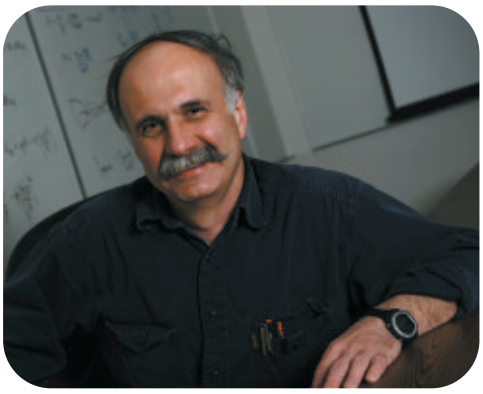
Mike Gruntman, chair of the Viterbi School's Astronautics and Space Technology Division, notes that the division already has degree programs focused on spacecraft engineering and says the microsatellite initiative "will open new, unique opportunities for students to be involved in real-world advanced space projects.

"This is the right technology at the right time in the right place," he adds.

Working with Will and Gruntman in the USC Microsatellite Systems Center will be ISI Division Director John Damoulakis, ISI Associate Director for Development Joe Sullivan and Dan Erwin, associate professor from the Astronautics and Space Technology Division.

Will holds research professor positions in the Viterbi School's Epstein Department of Industrial and Systems Engineering and the Department of Materials Science as well as in the Astronautics and Space Technology Division. He is a past winner of the Engelberger prize in robotics.

ISI recently received three research grants totaling $58 million from NASA and Gruntman is a co-investigator for the Interstellar Boundary Explorer *(see story on IBEX on page 5)*, a mission to explore the outer reaches of the solar system recently selected by NASA for development and launch in 2008.



From top to bottom; Peter Will, John Damoulakis, Dan Erwin and Mike Gruntman

Will photo by Eric Mankin, rest of photos by Brian Morri

Life & Legacy: Viterbi Museum Opens

A year after its own naming, USC's Viterbi School of Engineering welcomed back its namesakes — Andrew J. and Erna Viterbi — for Andrew's 70th birthday and the opening of the new Viterbi Museum in Tutor Hall.

Approximately 200 engineers, close colleagues, students, family and friends of the Viterbis joined the couple and Dean C. L. Max Nikias in an afternoon celebration March 9 to christen the new museum. The Viterbis made the trip from their home in San Diego, Calif., a day earlier to attend the Viterbi Conference and evening Viterbi Lecture, an annual lecture delivered by a distinguished leader in information technology and digital communications. This year's keynote speaker was Jacob Ziv, distinguished professor of electrical engineering at Technion Israel Institute of Technology.

"Today the USC Viterbi School begins drumming a rich new source of inspiration, a sparkling spring to refresh our spirit," said Nikias on the steps of Tutor Hall, referring to the museum that will showcase Viterbi's pioneering contributions to the field of digital communications. "The Viterbis don't need a museum. We, at USC, are the ones who need the Viterbi Museum to tell the story properly…

"The story is about the American dream, and the blessings of freedom. It's about innovations in technology and teamwork, and how they have become the key to the future of civilization. And it shows our students how their work can change the world," Nikias proclaimed.

The museum, housed on the second floor of Tutor Hall, was designed by A.C. Martin and Associates, the firm that designed Tutor Hall. Located next to the Baum Student Lounge on the southwest side of the building, the museum is divided into three rooms of display cases, artifacts, photographs, papers, mementos and a video presentation of Viterbi's illustrious career.

The family room traces the journeys of the couples families in Italy and Sarajevo prior to World War II, and each family's struggles to reach the United States. Back-lit displays describe Erna Viterbi's harrowing childhood of persecution in Sarajevo and Montenegro, Italy, the daughter of a Sephardic Jewish family, before the family was able to find refuge and eventually immigrate to Los Angeles. The Viterbi family fled from Bergamo, Italy, to New York Harbor in 1938, and then Boston where young Andy Viterbi grew up.

Erna and Andrew J. Viterbi

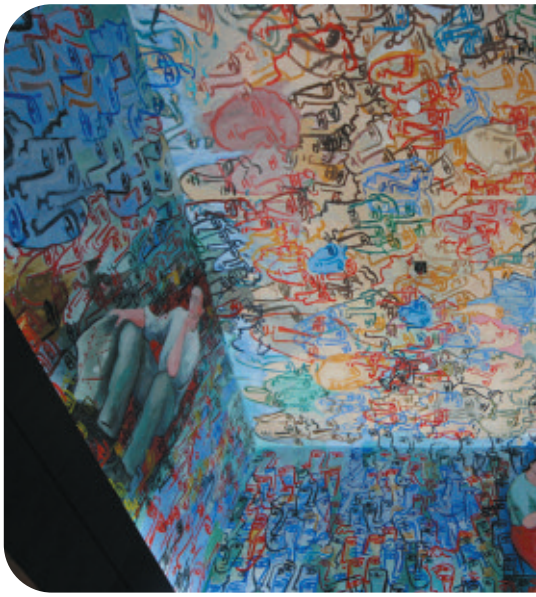
Impressionist Ceiling Mural

Looking up from the center of the room, visitors will see an elliptically shaped Impressionist ceiling mural, painted with bold brush strokes by the noted Italian artist Sandro Chia. The domical painting is a celebration of Andrew and Erna's union, bringing together the swirl of blue sky and earth as the two reach out for their futures.

The mural is lit with white lights to bring out the colorful hues of blue and sea green. The walls supporting the mural are made of Venetian plaster.

The gallery is the second and largest of the rooms, devoted to the technological innovations that Viterbi pioneered. Glass-encased displays, designed by Howard Sherman and Associates, document key moments in the young scholar's career with photographs, papers and magazine articles about his work.

Viterbi and a handful of other prominent pioneers in satellite communication are featured on the cover of a 1958 issue of *Life* magazine as they studied transmissions in the control room of *Explorer 1,* the first U.S. satellite to orbit earth *(see cover story of USC Engineer Fall/Winter 2004 issue)*. Viterbi's groundbreaking paper in 1967 describing an algorithm that would eliminate much of the interference in satellite communications at the time — the Viterbi algorithm — is also part of the collection. Additional display cases feature many of the electronics that revolutionized cellular communications.



The gallery ceiling features a second Chia mural, which is meant to convey Viterbi's overarching fascination with the spacelessness of wireless communications. Two "knife-

Photos by Brian Morri

Left; A colorful swirl of blue sky and ocean green bring heaven and earth together in this joyous scene of young Andrew and Erna Viterbi.

Bottom left; Faces of the past, present and future, all people Viterbi has known or has yet to meet, peer out in this Impressionist-style ceiling mural in the new museum library.

edged" soffits extend outward toward the center of the ceiling, like the underside of a roof overhang, without touching each other. The soffits create a space above the ledge that is illuminated with white lights, allowing visitors to peer over and beyond the horizon.

The third room is a library, where a selection of Andrew Viterbi's papers, books and other publications will be housed. The room is furnished with an Italian-crafted solid walnut table and chairs, and a built-in walnut bench along the west wall. A Chia Impressionist-style ceiling mural depicts faces overlapping each other, symbolizing all of the people Viterbi has influenced in the past, present and future.

Acquisitions Search Initiated

Nikias called the museum a valuable resource for scholars and announced the start of an international search for documents of historical value to the Viterbi Museum.

"We intend to make the Viterbi Museum an authoritative resource for scholars, so we are beginning an international search to secure an archive that will contain everything we know or we can learn about Andy Viterbi — stories, papers, pictures, technical contributions, anything and everything," he said. "Some of the leading lights of information theory and the communications sciences are with us today. Please spread the word in the community."

Nikias said that two families close to the Viterbis — Colleen and Roberto Padovani, who are Viterbi School parents, and Judy and Chuck Wheatley, who are close friends — have made substantial commitments to establish a $1-million endowment to give the museum permanent funding. The endowment will be used to make important acquisitions, develop outstanding exhibits and displays and procure new technologies for the collection.

"Both families have committed about half of that amount already," Nikias said. "The goal is to raise the rest by June 1."

Nikias emphasized the unique contribution the new Viterbi Museum will make to the overall history of information technology and wireless communications.

"The museum is not a tribute. The Viterbis don't need a shrine, nor have they ever asked for one," said Nikias. "The Viterbi Museum is a symbol of our unending gratitude to Andrew and Erna. And it's a symbol of their enduring commitment to education. Education is the great equalizer of society." —*DA*

Center Top; The Viterbis with their formal portrait and it's artist, Juan Bastos.

Top left; The Viterbi Museum opened to an enthusiastic crowd.

Middle; Andy with daughter Audrey and behind her, son Alexander, admiring the ceiling mural in the museum's library.

Bottom; Andy smiles with fond memories of his many accomplishments which are highlighted throughout the museum exhibit.

An Ear for Crime

A high-tech surveillance system being rolled out in high crime urban areas to stem gun violence comes directly from a USC Viterbi School researcher's pioneering brain studies.

Theodore Berger, director of the USC Center for Neural Engineering, who holds the David Packard Chair in the department of biomedical engineering, has spent much of his research life deciphering how nerve cells code messages to each other. Berger is also leading a project with the National Science Foundation's Biomimetic MicroElectronic Systems Engineering Research Center at USC.

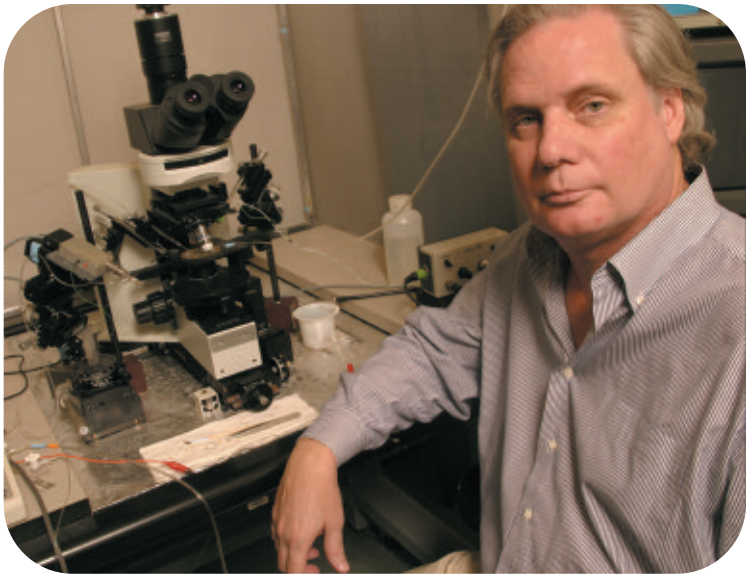
The newly patented microphone surveillance system uses Berger's insights to recognize — instantly, and with great accuracy — the sound of a gunshot, and only a gunshot, within a two-block radius. It precisely locates where the shot was fired, centers a camera on the shooter and places a 911 call to a central police station. The police can then take control of the camera to track the shooter and dispatch officers to the scene.

Late in 2004, the city of Chicago began installing the first five of a planned 80 of the devices in high crime neighborhoods, supplementing existing cameras. In Los Angeles County, Sheriff Lee Baca has been soliciting community involvement and participation to deploy 10 of the units in a pilot test. If the test is successful, more units will be installed.

Algorithms devised by Berger are at the heart of the "SENTRI" system, built by an Oak Brook, Illinois-based firm named Safety Dynamics, where Berger holds the position of chief scientist.

SENTRI uses acoustic recognizers, posted in trios or larger groupings on utility poles or other listening posts. The acoustic recognizers are tuned to certain specific warning sounds associated with gunshots. "A simple loud noise, even an explosive noise, won't set them off," Berger says.

The device listens for the entire sound pattern of a gunshot, not just the initial explosion, so it is unlikely to mistake other loud noises for gunfire. A specially configured computer system (a "directional analyzer") accurately triangulates any authenticated gunshot's location by calculating the difference in the time the sound arrives at the different microphones in a SENTRI acoustic unit. Then it points a camera, turns on lights, sounds an alarm and alerts police.



Theodore Berger

Field tests with handguns have shown 95% accuracy with respect to gunshot recognition, and 100 percent accuracy with respect to centering the camera on the shooter for those recognized gunshots.

SENTRI is an acronym for "Smart Sensor Enabled Neural Threat Recognition and Identification." The "neural" in the title refers directly to Berger's work, in which he has been deciphering the "language" that nerve cells, or neurons, use to convey information. He has been modeling the way the brain forms memories of sounds. Neurons distinguish signals by firing repeatedly, either faster or slower, in different temporal patterns.

"It is the time difference between pulses that carries the information," Berger explains. "This is a coding completely unlike that used by computers, which are collections of ones and zeros, changing to the beat of a constant clock."

Working with computer specialists, Berger has created neural-like computer systems that can model the neural time coding and make distinctions the way nerves do.

Working with computer specialists, Berger has created neural-like computer systems that can model the neural time coding and make distinctions the way nerves do. Four years ago, he and a colleague used the technique to demonstrate the first speech recognition system that could pick words out of ambient noise as well as humans can. While work continues on speech recognition applications, the system has to learn each individual signal, and every word is a signal, so that learning a language is a time-consuming process.

"But for alarm signals," says Berger, "you start with a relatively small number of sounds you have to distinguish with high accuracy — gunshots, for example, or diesel engines for border patrol crossings or oil pipeline thieves, or chainsaws (and diesels) to listen for outlaw loggers — this vocabulary is quite manageable."

Machine sounds are the only ones in SENTRI's vocabulary. It cannot eavesdrop on conversations, the scientist emphasizes.

Berger has been working to create a silicon system that can be transplanted into living brain or other nervous tissue to restore function lost to disease or injury. The current line of research that led to the gunshot recognition is being expanded in collaboration with computer scientist John Granacki at the Viterbi School's Information Sciences Institute.

For more information, visit the following web pages: Biomimetic MicroElectronic Systems (BMES) Center http://bmes-erc.usc.edu/; Safety Dynamics http://www.safetydynamics.net/index.htm; Speech Recognition http://www.usc.edu/uscnews/story.php?id=4829; Building the Bionic Brain http://www.usc.edu/uscnews/story.php?id=8470; Neural Computing http://www.usc.edu/uscnews/story.php?id=821

—EM

Berger photo by Max S. Gerber

USC Viterbi School Offers the Nation's First University-based Air Security Classes

Safety and Security instructors, from left, Alfred Dickinson, Glenn Winn, Kristopher Cannon and Bill Fabie shown with safety expert Mike Barr.

It was Valentine's Day and the lecture room was filled with attentive listeners. Across the screen raced a flood of details about airplane bombings, portraits of terrorists and photos of machines designed to detect explosives. Outside the window lay one of the world's busiest international gateways, Los Angeles International Airport, or LAX.

Those not especially interested in the technology for detecting trace amounts of nitrate — the signature of most explosives — on clothes, baggage, perspiration or even on airline boarding cards — might not have found this to be the most interesting way to spend two days in the middle of February but for this audience, every word was critical. Every pupil had a serious responsibility to keep air operations secure.

And USC was teaching them how.

The class was a landmark for the Viterbi School's highly successful 53-year old Aviation Safety Program — one that has changed the program's name to the Aviation Safety and Security Program.

More than 20,000 air professionals from 20 nations have previously taken courses in the USC Air Safety and Security Program, which moved in 2001 from campus to its present location adjacent to the airport. The new class attracted a new audience of security professionals.

According to program director Alfred Dickinson, students in the first class came from government (the Nigerian Civil Aviation Authority, the Bahamas Government Airport Authority), airlines (Delta) and aircraft manufacturers (Boeing and Bombardier Flexjet), while others were from entities such as Cigna Corp. and the United Nations.

The topics included vulnerability assessment, security organization, education and training, and implementation of security plans, including both legal and practical aspects. Participants gave it high marks in post-class evaluations.

"It highlighted the dangers of not having security programs in place," said one participant. "The mix of insight was good — an understanding of both the law enforcement side and corporate aviation," said another. "Great!" was the one-word assessment of a third.

The lecturers for the course included FBI special agent, Bill Fabie, and USC safety program alumnus, Glen E. Winn, a Marine Corps combat veteran and former secret service agent who has long worked for United Airlines security operations.

The course, entitled simply "Aviation Security," will be repeated in October, possibly in a three-day as opposed to two-day format. Responding to demand, Dickinson has scheduled a second course, "Threat and Error Management," on how to integrate security concerns into a general strategy to increase safety margins across the board. More security courses will be introduced in the coming year.

Dickinson said the initial impetus for the security focus came from USC's selection as the home for the first Department of Homeland Security (DHS) University Center of Excellence. USC's center, called CREATE (or Center for Risk and Economic Analysis of Terrorism Events) is helping government and industry develop cost-effective investments to protect against terrorism.

CREATE is currently conducting research on the threats posed by weapons, such as surface to air missiles, to commercial aviation.

"The Aviation Safety and Security Program is letting us turn research into practice by educating professionals to improve the security of the world's aviation system," said Randolph Hall, co-Director for CREATE, and senior associate dean for research in the Viterbi School.

"Both this program, and USC's new master's degree in System Safety and Security, are building the nation's leadership to defeat terrorism," Hall continued.

"We're meeting the needs of the future," said Mike Barr, former Aviation Safety Program director and the program expert in crash forensics who in March celebrated his 20th year with USC.

Barr, a combat fighter pilot who logged 137 missions in Vietnam, said that initially the program did not have experts in the area of security. However, it did have an extremely well developed and successful four-part approach for dealing with risk. These are:

- Identify hazards
- Assess hazards
- Mitigate hazards
- Check the effectiveness of the mitigation, and continue to monitor.

"This is applicable to security as well as safety," Barr said.

While the new security elements are added, Dickinson and Barr both emphasize that the traditional work of the program on safety is continuing with vigor. Thirteen different safety courses, ranging from "Aviation Safety Management Systems" to "Gas turbine Accident Investigation," to "Legal Aspects of Aviation Safety" and "Software Safety" will be offered this year, along with two separate certificate programs.

A certificate program for Security is on the way as well, Dickinson said. And, in the more distant future, working with CREATE, a degree program of some kind may be possible as well. "We would love to see this," he said.

More information on the aviation program can be found at: http://viterbi.usc.edu/aviation Information on the new Masters in System Safety and Security can be found at: http://www.usc.edu/dept/create/education.php —EM

student works

A Concrete Canoe with All the Right Ingredients

USC team takes fifth place in ASCE Pacific Southwest Regional Conference

Take a sack of Portland cement, add a dash of plastic cement and fly ash, mix with some low-density glass beads and leaven with water to obtain the correct water-cement ratio; apply three layers to a wood-and-Styrofoam canoe hull, let cure for 28 days, and *presto* — a concrete canoe fit for competition.

That's USC's recipe for the 18-foot-long, 120-pound canoe, named "Sea-Zure," which was the Viterbi School's entry in the 2005 Pacific Southwest Regional Conference (PSWRC) on the Cal State University, Fullerton campus. The canoe competition, which is cosponsored by the American Society of Civil Engineers (ASCE) and Master Builders, Inc., was held April 2 at Puddingstone Lake, near the Cal State campus.

Fourteen undergraduate civil and mechanical engineering students designed the School's canoe. They competed against engineering students from more than a dozen university campuses in the Southwest in a test of brains, not brawn.

What's concrete canoe racing all about?

"It's about making concrete buoyant enough to float and learning about canoe construction, "said Richard Stegemeier, a junior civil and environmental engineering student who was captain of the 10-member team. The competition isn't designed to be an Olympic racing event, but rather to encourage innovative thinking and to give promising young students a venue to show off their engineering prowess.

Design Features

The four-person canoe was hatched last October, when the engineering students first met to brainstorm ways to improve last year's entry. The canoe was affectionately dubbed "Helen," for Helen of Troy. The students focused on three areas: canoe design, construction and selection of materials.

After designing the canoe's form — a mold made of Styrofoam sheets that were glued to pre-cut pieces of wood — they concocted and tested different concrete mixes to find the perfect light-but-strong mixture.

"We used micron-sized glass beads, an aggregate that is low density, then varied the water-cement ratios until we came up with a mixture that worked," said Jamie Adams, a senior civil engineering student, who grew up in Hawaii and is an experienced paddler. "The mixture is basically 50 percent binding materials and 50 percent aggregates. We had to keep it light weight, so we tested the strength basically by breaking the concrete apart."

Left to right; Jamie Adams, senior CE, Bao Tran, junior CE, Richard Stegemeier, junior CE, Blake Nelson, sophomore CE, Keoho Enomoto, junior CE.

Three layers of concrete are applied to the canoe's mold, each layer divided by fiberglass mesh to add strength, explained Arash Malakan, a Ph.D. student in civil and environmental engineering.

"This is the same technique that is used to build most concrete structures," Stegemeier added. "Concrete does not withstand tension, so we used mesh to increase tensile strength. In large concrete structures, builders will use steel reinforcing bars to strengthen the concrete."

Layering and Curing

Between layers, the students had to cover the boat with a plastic tarp to keep the cement moist and prevent it from cracking, said Katharina Zappei, a freshman who plans to declare a major in civil engineering. When the cement has dried, the mesh is cut away from a tension apparatus that keeps it tightly stretched during construction.

"It takes about 28 days to reach the desired compressive strength after it has

Left; Jamie Adams scoops up glass beads, one of several ingredients used to make the concrete canoe.

Right; Richard Stegemeier, captain of the canoe team, spreads out mesh that will cover the first layer of cement on the canoe hull.

been poured," said Stegemeier. "Then we sanded the canoe and applied a sealer to the inside and outside of the hull."

The annual ASCE Pacific Southwest Regional Conference is a competition of university students from 16 civil and environmental engineering schools in Southern California, Nevada, Arizona and Hawaii. Eighteen regional events were held in late March and early April.

The Viterbi School team selected four paddlers and one alternate to compete in five distance and sprint races. In addition to the races, the team was judged on oral and written presentations and a display of their canoe design, construction and materials. *—DA*

The China Connection

USC Viterbi School Unveils China Strategy

In a whirlwind trip to Beijing, Dean C. L. Max Nikias took the first steps toward implementing a strategy to increase the Viterbi School's ties with China.

On March 1 in Beijing, the dean and Dongcheng Hu, vice president of Tsinghua University and dean of the Tsinghua School of Continuing Education, signed a "Letter of Intent for Collaboration" in which the two schools agreed "to collaborate in continuing education, distance education and mutually explore areas of interest."

"Tsinghua University is one of the most important universities in the world today and is known as the MIT of China," says Nikias. He added that the Viterbi School receives about 110 applications per year from Tsinghua students wishing to study at USC. "This agreement promotes USC's internationalization strategy and builds on one of the Viterbi School's great strengths, its Distance Education Network."

The Viterbi School's Distance Education Network (DEN) currently offers 26 engineering masters degree programs over the Internet — more than any other engineering school — using cutting edge, high-speed interactive Internet technology. DEN students take the same accredited courses from the same USC faculty and must pass the same exams as on-campus students.

Beijing's Tsinghua University, founded in 1911 on the former imperial garden of the Qing Dynasty, has 13 schools and 53 departments and is focused on science and engineering. The School of Continuing Education is a key component of Tsinghua, providing multi-level and high quality educational programs including professional training, distance education, international cooperative training and adult education in a variety of disciplines and fields.

The signing of the agreement followed a meeting between Nikias and Binglin Gu, president of Tsinghua, and was facilitated by a gift from Feng Deng (MSCS '93), a Silicon Valley entrepreneur born in China who is an alumnus of both universities *(see new BoC profile of Deng on page 50)*.

"Feng Deng is a powerful role model not only for our students, but for students in China," says Nikias. "He is benefiting both nations by bringing these two institutions together."

While in China, Nikias met with another USC Viterbi alumnus, Chengyu Fu (MSPE '86) who is chairman and CEO of the China National Offshore Oil Corporation (CNOOC) Limited, which exploits China's offshore petroleum resources.

"We discussed distance learning opportunities, specifically IT (information technology) for the oil industry," explains Nikias. "There is interest from both of us to pursue this further."

Finally, Nikias found time for his first visit the Great Wall.

"It is an awe-inspiring sight and a profound reminder of China's long and hugely important historical presence in the world. It was also very cold and a reminder of Southern California's charms," he says. "We have a China strategy, one that is based on our amazing Trojan Family, which can be found all over the world."

Right; Executive Director of Development for the Viterbi School, Barbara Myers, Dean Nikias and DEN Marketing Specialist Camillia Lee at the Great Wall.

Far right; Alumnus Feng Deng, Dean Nikias, Alumnus Chengyu Fu, chairman of China National Offshore Oil Corporation (CNOOC) and Lewis Lu Xiaofeng, External Affairs for CNOOC meet to discuss collaborative projects.

Making Waves with the Surfrider Foundation

Not all waves are bad.

When USC researcher José Borrero came back home in January from Banda Aceh *(see story on page 33),* he headed immediately to the Fourth International Surfing Reef Symposium in Manhattan Beach. Long before the devastating tsunami struck in December, he had helped organize the symposium and felt an obligation to attend.

Co-hosted by USC and The Surfrider Foundation, this unique biennial conference brings together oceanographers, engineers, coastal zone managers and surfers from around the world for a serious discussion of topics vital to the health and preservation of Southern California's coastal environment. Sessions focused on natural and artificial surfing reefs, reef preservation, human impacts on surf zone environment and the economy of surfing. Borrero co-organized the symposium with Surfrider Foundation's Chad Nelsen.

"Our goal in hosting this symposium is to continue a trend that began with Kimo Walker in the 1970s," Borrero said. "Though still in its infancy, there is a growing interest in better understanding the science, economics and management of surfing. The purpose of this conference is to advance the scientific understanding of how waves break, specifically the types of waves ridden in recreational surfing."

More than 25 papers were presented at the conference, as well as a variety of planned presentations and discussions on such topics as existing reef projects (monitoring and performance), design and proposed reef projects, studies on natural surf breaks and the future of surfing science, research needs and goals.

One of the highlights was a discussion of the lessons learned from the Pratte's Reef project in El Segundo and results of four years of monitoring an artificial reef in Narrowneck, Australia. Additional discussions addressed the future of other artificial reefs, such as the reef planned for Oil Piers in Ventura County.

For more information visit: Surfrider Foundation http://www.surfrider.org

Grid Software Moving from Science to Business

The world's leading information technology companies have formally endorsed the open source grid software package co-developed by Carl Kesselman (MSEE '84) of the USC Viterbi School of Engineering.

Kesselman is director of the Center for Grid Technologies Research at the Viterbi School's Information Sciences Institute (ISI) and a research associate professor in the department of computer science. He is also an ISI fellow.

He and longtime collaborators Steve Tueke and Ian Foster of the Argonne National Laboratory built the Globus Alliance, whose Globus Toolkit has become the *de facto* standard for grid computing since its introduction in 1996. They are now observing the creation of the Globus Consortium, which includes IBM, Intel, Hewlett-Packard and Sun Microsystems. According to *The New York Times,* the consortium "will cooperatively develop software tools more suited for business uses of grid computing, and educate companies about the technology and its potential."

Carl Kesselman

Scientific users around the world are already using Globus software to allow seamless sharing of computational resources such as machines, data, sensors and more. Grid computing has facilitated scientific enterprises such as NEESGrid, which was set up to advance computationally intensive research and modeling in earthquake safety. Climatologists, molecular biologists and high-energy physicists are also confirmed users of the software, which Kesselman and his colleagues began creating nearly a decade ago.

Business users have also started using Globus for advanced applications. For example, SAP is using Globus to demonstrate dynamic deployment and integration of new servers into applications. The Globus consortium is expected to accelerate the adoption of Globus technology in commercial applications.

To foster the spread of Globus into the commercial world, the Globus trio created Univa Corp, a company focused on providing commercial support for the open source toolkit and business oriented solutions based on the Globus toolkit. Tueke is Univa president/CEO and Kesselman is chief scientist.

"The problem is that open source Globus software is still largely unpackaged and unsupported for enterprise use. That's where Univa comes in," says a statement on the company's web site.

"Grid computing has only begun to realize its potential in business," says Kesselman. "We think that such applications as on-demand deployment, enterprise based resource management and custom and general purpose grid based solutions from independent software vendors will be in place in the next three to four years."

The Globus scientists have won numerous honors, including 2003 Finalist, World Technology Award for Information Technology Software; 2003 *InfoWorld* Top 10 Innovators; 2003 Federal Laboratory Consortium (FLC) Award for Excellence in Technology Transfer; 2002 *MIT Technology Review* Ten Technologies that will Change the World; the 2002 British Computing Society Lady Ada Lovelace Medal; 2002 *R&D Magazine R&D* 100 Award; and 2002 *R&D Magazine's* Most Promising New Technology Award (best of the R&D 100.)

Photo by S. Peter Lopez

Wars of the Virtual Worlds

Every few months, a continent crackles into life on linked supercomputers. It is a place of huge cities surrounded by countryside with an intricate network of roads where thousands of trucks, tanks, mopeds, other vehicles and pedestrians move.

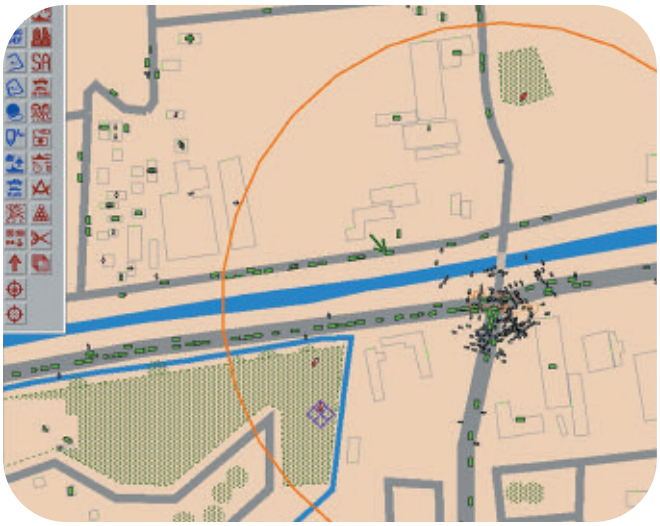
The newly created world is an electronic arena in which top military officers of the U.S. Joint Forces Command (JFCOM) develop tactics for the future — an arena that has taken a significant leap in complexity in the past three years, courtesy of computer skills from the Viterbi School's Information Sciences Institute (ISI).

The ISI-JFCOM team's simulation software is "scaleable," or not artificially limited to a small number of simulated participants. ISI has collaborated with Caltech, Lockheed Martin, Alion Sciences, SAIC and Toyon and in March, the scientists received a bridge grant to continue their efforts.

"Urban Resolve," one experiment in this series, set in the year 2015, involves a U.S.-led coalition force that must confront and overcome a skilled adversary equipped with modern capabilities and operating in an urban environment.

Two groups of officers — the blue team leaders of the coalition, and the red team leaders of the adversary — control their forces from separate command posts, rooms full of monitors where specially trained aides make the moves ordered by commanders. The aides are called "puckers" — a holdover from the days when military exercises were conducted on huge tables and soldiers pushed model ships or tanks ("pucks") around with sticks. Two other computer control rooms complete the set-up. A green team controls the "clutter" — vehicles, pedestrians and other facets of the civilian population — not part of the forces of either side. Finally, a white room for the experiment's umpires offers a combined view of operation — a so-called "angel's eye view."

Puckers for green, red and blue teams add vehicles to the world by selecting them from a menu of thousands of pre-written units of software code, each describing the behavior of a specific vehicle — taxi, tank or city bus. Some of the vehicles have very complex behavior sets, but even the simple robots "know" how fast to go on which roads, turn corners, avoid collisions and stay on the road.



Top; Puckers-eye view: the two-dimensional map representation shows vehicles moving in an urban landscape.

Bottom; The 3D view from the green arrow viewpoint.

They are also time-sensitive, crowding the roads during morning and afternoon rush hours. A select few — most of them combat units — are far more complex, endowed with artificial intelligence that allows them to respond and react to changing circumstances in complex ways.

Simple or complex, the population of the arena world used to be much smaller.

"For a long time, there was an unacceptable ceiling for the number of the vehicles that could be simulated on individual workstations on a local network," said ISI project director Dan Davis, a Marine Corps veteran who has turned his combat-zone experience to good use. "They couldn't get much above about 30,000."

Robert Lucas, director of the computational sciences division at ISI, broke this barrier with a major event in 2002. That event was the record for SemiAutomated Forces so far: one million entities.

"While we are hesitant to say just exactly where the final limits may be," Davis says, "we now see no immediate constraints on the delivered scalability."

The experiments in 2004 used about 100,000 entities, employing cluster supercomputers located at two military supercomputing centers, one in Ohio and another in Maui. All experiments are directed from the Joint Experimentation Directorate in Suffolk, Va., with two other sites where controllers and analysts work: the U.S. Army Topographic Engineering Center at Fort Belvoir, Va., and at the Space and Naval Warfare Systems Command facilities in San Diego, Calif.

ISI computer scientists Ke-Thia Yao, Gene Wagenbreth, Brian Barrett and John Tran also participated in the effort. Tran, who joined the team two years ago, may soon have an opportunity to see in real life some of the issues he has been simulating. He has just been called up for six months of reserve duty. —*EM*

IMSC's New Direction: A Visit with Director Adam Powell

When Dean C. L. Max Nikias named Adam Clayton Powell III, to be the new director of the Integrated Media Systems Center (IMSC), he hailed him as "a creative technologist, outstanding leader and the ideal person to take IMSC through its next phase."

In addition to Powell, Nikias announced several other leadership changes at IMSC. Chris Kyriakakis, a longstanding IMSC research leader in immersive media and a member of the electrical engineering faculty, became deputy director. Computer scientist

Adam Clayton Powell III

Ulrich Neumann, who had served as IMSC's director since 2001, became associate director for research. Other associate directors are Anthony Borquez, for education; Alexander Sawchuk, who will be responsible for research instrumentation and research in 3-D displays; and Mike Zyda who will be associate director for games technology.

In 1996, the National Science Foundation selected USC's proposal for the IMSC over 117 others to make it the exclusive NSF Engineering Research Center for multimedia and Internet research. Since then, the IMSC has been developing unique Internet and multimedia technologies. Applications of IMSC technologies have found their way into distance education, teleconferencing and musical performance. Many have also been commercialized and are in use by Hollywood companies and consumer electronics manufacturers. Remote Media Immersion to capture, transmit and render immersive sound and high-definition video over the Internet combines several of these technologies.

As of last year, IMSC researchers had published 439 peer-reviewed articles in technical journals, 1,387 articles in peer-reviewed conference proceedings, and another 29 in trade journals. The IMSC Press has published 10 books with Prentice Hall PTR. In its first eight years, IMSC funding totaled more than $70 million and 68 companies have funded IMSC research. The IMSC has filed 106 invention disclosures and 56 patent applications. Six patents and 84 licenses have already been issued.

The IMSC has also contributed its unique flavor to USC's mix of educational programs with six distinct and successful education programs in multimedia and creative technologies. These include four new master's degree programs and two new bachelor's degree minors. A total of 237 students have graduated from USC who participated in the IMSC. This includes 16 B.S., 85 M.S. and 136 Ph.D. students. Last year alone, we had 142 doctoral, 61 masters and 29 undergraduate students working on IMSC projects.

As part of its educational outreach, the IMSC started the Multimedia University Academy (MUA) to provide high-tech skills to at-risk, inner-city youth and help them find jobs or attend college. Another outreach program re-trained and placed more than 235 unemployed workers between 1996-1999.

During its first phase, the IMSC organized and began to build ambitious research, education and industry collaboration programs around a far-reaching vision. In its second phase, the transformation of the vision into real technologies has taken place successfully. Now that IMSC is entering a third phase, *USC Viterbi Engineer* interviewed Powell to learn more.

USC Viterbi Engineer: In a nutshell what will we see in IMSC's next phase?

We are going to be moving technologies into society more rapidly through partnerships with key industries, arts institutions and K-12 schools, with an emphasis on connecting with underserved communities. At the same time, we will continue to move the research program forward and pursue more cross-disciplinary collaborations with other USC units and with entities outside of USC. We will also increase focus on video game technologies to take advantage of our location in the hub of that industry.

How will it relate to USC's new strategic plan?

The strategic plan talks about meeting societal needs, expanding our global presence and promoting learner-centered education. The NSF started the ERC program with societal needs in mind. A major goal of ERCs is to rapidly develop technologies deemed critical to the nation and to arm the workforce with the skills needed to compete globally in these critical areas. So, I believe the IMSC has been meeting societal needs and promoting learner-centered education since it began. We've been less successful establishing a global presence, but that is something we're going to work very hard on in this next phase.

With what other parts of USC do you think IMSC will forge cross-disciplinary collaborations?

We've had longstanding collaborations with the Annenberg Center for Communication and with the Annenberg School. In more recent years, we've started some exciting projects with the Thornton School of Music. Some of our researchers have been involved with ICT (Institute for Creative Technologies) since it began, and that will increase. We're working more closely with ISI (Information Sciences Institute) and I certainly see productive partnerships with many other USC units.

What about video games? What kind of research will IMSC be doing and how will it relate to what is going on in other parts of USC such as ICT, ISI, CNTV, etc.

Southern California is the world center of the video game industry and USC has all of the

ingredients that go into video games. But it is spread all around the university in many different units. It is a real opportunity for all of us to form great cross-disciplinary collaborations and leverage our individual strengths. And the industry really needs this kind of support. In the future, the near future, hit games are going to come from engineers with M.S. degrees who understand AI (artificial intelligence) and who can use it to create rich characters and compelling interactive stories. They'll have to work very closely with story tellers and artists to be successful. IMSC has been oriented to such collaborations since its inception so I think we are in a great position to provide leadership in this area.

You have some plans for non-traditional programs. Could you tell us more about them?

We are expanding our outreach to K-12 educators, to low-income and traditionally disadvantaged communities, to disabled users and to international partners who are not typical members of high-technology collaborations, such as rural Africa.

We want to forge partnerships with institutions that can use the unique set of tools IMSC has developed and is developing to address a broad range of needs of societies here and in other parts of the world. We already know there are applications in education, in health care, in arts and culture and museums. But we are also already being approached by prospective partners with applications that we had not considered for immersive and augmented realities.

The key in all of these areas is that IMSC's research is web-based. That means it is accessible wherever we have decent Internet connections, which nowadays is almost anywhere. In my technology work, I've been to remote towns in places ranging from the Andes and to the middle of the Sahara, and it's been years since I have found any location that is not connected, sometimes in novel and surprisingly effective ways, to the Internet.

—BC

ChevronTexaco-funded Research Center Holds First Annual Meeting

After considering a wide range of possible research areas and business challenges for the Center for Interactive Smart Oil Technologies (CiSoft), ChevronTexaco and the USC Viterbi School have decided to focus on seven.

They are:

- Integrated Asset Management
- Well Productivity Improvement
- Robotics and Artificial Intelligence
- Embedded and Networked Systems
- Reservoir Management
- Data Management Tools
- Immersive Visualization

"It was a two-sided effort," says Mike Hauser, CiSoft's co-executive director and the i-field ("integrated field") program manager for CiSoft sponsor ChevronTexaco. "From the CVX [ChevronTexaco] side, the question was 'what are our needs?' From the USC side, it was 'what is our expertise?'"

Hauser spoke at a conference expected to be the first of an annual series, in which 19 Viterbi School faculty now involved with CiSoft projects met with engineers and technologists from ChevronTexaco and other corporate sponsors.

CiSoft was established in December 2003. Projects started six months ago following an intense period of what Hauser called "organized brainstorming." He and the other co-executive director, Iraj Ershaghi, professor of petroleum engineering at the Viterbi School, led the joint effort to define the research agenda.

There are currently between two and four Viterbi School faculty for every representative of ChevronTexaco or another sponsor working on each of the research projects. Other sponsors include Schlumberger, SAIC and Microsoft.

In addition to Ershaghi, Viterbi School researchers Joseph Bannister of the Information Sciences Institute Networks Division and Ulrich Neumann of the Integrated Media Systems Center sit on the six-member decision review board overseeing CiSoft projects. The other members are Alan G. Nunn, general manager of Global Technology and Strategy at ChevronTexaco, and Warner M. Williams of the Chevron Texaco's San Joaquin Valley Business Unit.

Iraj Ershaghi and Mike Hauser

Hauser says that some of the problems chosen were those where it seemed reasonable to expect usable results within a one to two-year time frame.

"This means, yes, we do expect to have this technology in use by 2006, either in pilot or full-scale application. Other projects will target opportunities three- to five-years out," he explains.

Participants from all seven research areas presented reports for discussion during the two-day event, which also included a keynote speech: "Technology Unlocking New Barrels" by ChevronTexaco Vice President Melody Meyer.

Ershaghi says that the research effort was taking place in tandem with the development of an educational curriculum to teach the emerging techniques to engineers. Four new graduate courses on smart oil production, PTE 586, 587, 588 and 589, are now in the curriculum.

Hauser is enthusiastic about his experience so far working with the USC Viterbi School. "It's been a refreshing change from our short-term production world to be able to interact in a venue where we can think more innovatively. USC has so far more than met our expectations."

More Efficient Patient Flow Management May Benefit LA County/USC Hospital

Using techniques from the industrial world, a team of USC Viterbi School engineers is working to dramatically trim delays and relieve overcrowded conditions in large hospitals. At Los Angeles County/USC Medical Center, they are finding more efficient ways of managing triage, scheduling and routing of patients.

"County/USC Hospital serves an enormous population in the region, with many patients going to the emergency room first, so the waits can be long," says Randolph Hall, principal investigator, professor of industrial and systems engineering and senior associate dean for research in the Viterbi School. "Given the hospital's budget constraints, it's really critical that they develop systems and procedures to move patients through the hospital as efficiently as possible."

It is the first study of its kind for USC Viterbi School of Engineering. Hall and engineers in the Daniel Epstein Department of Industrial and Systems Engineering partnered with Los Angeles County/USC Hospital to model the entire hospital, from top to bottom, as an integrated system. Their objective was to identify the most significant bottlenecks, as well as the highest payoff strategies, for improving patient flow.

The 1,395-bed L.A. County/USC facility, located in East Los Angeles, is one of the nation's largest public hospitals. Run by the county, it is a partner institution of the Keck School of Medicine of USC that treats approximately 800,000 patients annually, including at least 200,000 emergency room visits. According to hospital records, almost half of those treated are indigent or uninsured.

In order to keep up with the demand, Hall says, patients must be transferred without delay from emergency room triage to ancillary services, such as radiology departments, for x-rays, CT scans, MRIs and other diagnostic tests, or on to operating rooms for surgery. Those who need to be admitted to the hospital must wait longer for a bed to become available. This depends on the speed at which other patients are discharged or transferred among different locations and how long it takes to prepare the freed up rooms.

"All of these departmental activities are interdependent as patients flow through the emergency care system," Hall explains. "It's like a domino effect. If there is a delay in any one of those steps, every other department down the line will experience a delay."

Hall, co-principal investigator Maged Dessouky, an associate professor of industrial and systems engineering, and David Belson, senior research associate and lecturer in the Epstein Department, first identified the most critical issues that caregivers believe they face while serving patients.

"We talked to triage nurses to find out how patients are classified based on their level of medical need," Belson says. "Do they give gunshot victims or accident victims priority over someone having a heart attack? Then we looked at the degree to which the triage decision process ties up available resources, such as specialist physicians or equipment. Maybe the emergency room is taking away all of the hospital's resources to treat in-patients, which means they will stay longer and you'll have fewer beds for newly admitted patients."

The researchers applied engineering techniques widely used to improve the performance of manufacturing, distribution and transportation systems to design a flow chart of hospital operations.

"The engineering approach makes this study unique," says David Altman, assistant dean of the Keck School of Medicine. "We're looking at process issues that we don't normally look at. There's a lot that the industrial world has been figuring out that we don't know much about in health care, but it could be applied to us and be tremendously beneficial."

The researchers used information from more than 100 hospital administrators and clinicians to document processes currently in use for triage, scheduling and routing.

"One of the major bottlenecks seems to be occurring in ancillary services, such as radiology," Altman says. "Ancillary services are at critical junctures of just about every hospital procedure, but these services have limited capacity and staff does not answer to the people who are responsible for the patients. So a patient could wait days before his or her surgery is scheduled, or hours for an x-ray."

Left to right; USC engineers Maged Dessouky, Randolph Hall and David Belson discuss the patient flow study on the steps of the hospital.

Photo by Irene Fertik

Discharging patients from the hospital is another time-consuming process, says Paula Packwood, chief of staff in the Los Angeles County Department of Health Services.

"We know that we have problems with some of the more complex patient discharges because the patients are uninsured and they don't have a lot of options for care when they leave," she says. "A systems approach to the problem is really like a new way of thinking about things."

For example, Packwood says there might be a better way to coordinate interdepartmental scheduling of patients who are ready to be discharged and that "with all of the new technology that's available, we might be able to develop better software tools to make these administrative processes more efficient."

In the next phase of the work, Dessouky, who specializes in simulation and modeling, will develop a testbed to connect all patient flow activities together and gather data for analysis. Using this data, he and his colleagues plan to develop new patient flow models and

data management tools.

They will model the processes for patient discharge, organization and assignment of responsibilities to departments, scheduling procedures for operating rooms and nursing staff, and forecasting patient volume for a particular day and time. Dessouky says he will examine in more detail the routing procedures, which involve sequencing all of the tests and examinations each patient needs.

Hall points out that the emergency room, which takes in approximately 85 percent of all new inpatients, stands to benefit greatly from the hospital's ability to implement streamlined administrative processes. Staff will be able to triage and schedule patients with fewer delays and provide new patients with more accurate estimates of wait times.

In parallel with new and improved procedures to manage patient flow, engineers in the Viterbi School are also developing a collaborative educational program with County/USC, which will include student placement in the hospital and a new course in industrial engineering on patient flow improvement.

"This will be an excellent way for industrial and systems engineering students to gain hands-on experience," Hall says. "Once our testbed is fully implemented, we will be able to collect real-time data automatically.

"In the future, we'd also like to develop a capability to remotely access the data from campus, so that students and faculty working on the project would be able to monitor and implement software updates for the hospital when needed," he says. —*DA*

Cornelius Pings Dies at 75 **Engineer, Provost and AAU President**

Cornelius Pings

Cornelius J. Pings, a distinguished chemical engineer who served as USC provost and then president of the Association of American Universities, died of cancer on December 6, 2004. He was 75.

Pings, USC's provost and senior vice president for academic affairs from 1981 to 1993.

His position oversaw the academic and research programs in all of the university's schools, the libraries, student affairs and community and governmental relations.

"Neal was a devoted colleague and friend. He was chief academic officer at this university in a decade remarkable for its gains in academic quality," says USC President Steven B. Sample.

"He worked tirelessly for higher education, but that is not the full measure of the man. Neal also made a lasting contribution to the communities in which he lived and worked.

"He was a good and dedicated citizen who worked hard for the public good. We will all miss him."

USC Viterbi School Dean C. L. Max Nikias said that Pings' stewardship laid the foundations for steady and then increasingly rapid improvement in engineering. "We are still building on his foundation," Nikias explains.

From 1993 through 1998 he was president of the Association of American Universities. The Washington, D.C.-based AAU represents the nation's 60 major research universities.

In 1988, Pings was appointed chairman of the Committee on Science, Engineering and Public Policy, a post that earned him national attention in higher education circles. A joint committee of the National Academy of Sciences, the National Academy of Engineering and the Institute of Medicine, the group was charged with addressing the health of U.S. science and technology.

From 1987 to 1989, Pings chaired an *ad hoc* committee for the AAU that undertook a major review of "Indirect Costs Associated with Federal Support of Research on University Campuses." The committee's report, which became known nationally as the "Pings Report," considered and offered resolutions for a number of contentious research-related issues among government officials, faculty and university administrators.

Pings was a member of numerous prominent scientific organizations, including the National Academy of Engineering, the American Academy of Arts and Sciences, the American Institute of Chemical Engineers and the American Chemical Society. He received several awards from groups including the American Society for Engineering Education and the American Institute of Chemical Engineers.

Pings, a Pasadena resident, came to USC from Caltech, where he was vice provost and dean of graduate studies from 1970 to 1981. He joined Caltech as a professor of chemical engineering and chemical physics in 1959 and earned his bachelor's degree in applied chemistry and his Ph.D. degree in chemical engineering from the school in 1951 and 1955, respectively.

Pings was a founding director of the Pacific Horizon Funds, serving from 1982 to 1999, and director, president and chairman of the board of Bank of America mutual funds from 1996 through 1999. He also held leadership positions with Farmers Group Inc., Hughes Aircraft Co., Maxtor Corp., Edelbrock Inc. and Amervest Co. Inc., among others.

After serving on a blue-ribbon committee organized by then-Los Angeles Mayor Tom Bradley, Pings was appointed to the executive committee of L.A. 2000. In 1992, he chaired the Central City Association.

He was a trustee of the Mayfield Senior School of Pasadena and belonged to the California Club, the Bohemian Club and the Twilight Club of Pasadena. In 1981, he received the City of Pasadena's Arthur Nobel Medal.

Pings' other activities included service on the education and finance committees of the Roman Catholic Archdiocese of Los Angeles. He was a Knight of Malta and in 1998 Pope John Paul II appointed him Knight Commander of the Order of St. Gregory.

A native of Conrad, Montana, Pings is survived by his wife of more than 40 years, Marjorie; his son, John; and his daughters, Anne and Mary.

Memorial donations may be sent to the Neal Pings Memorial Research Fund, USC/Norris Comprehensive Cancer Center and Hospital, 1441 Eastlake Ave., Room 8302, Los Angeles, CA 90033-1048. A memorial service was held Dec. 11 at the Cathedral of Our Lady of the Angels in Los Angeles.

Tutor Hall Opens its Doors

The USC Viterbi School's new Ronald Tutor Hall — a six-story, state-of-the-art instructional and research complex on the south side of the engineering quad — officially opened its doors February 2 to faculty, staff and students, 18 months after construction began.

Trojan engineers have a new home

by Diane Ainsworth

Photos by Max S. Gerber

Dedication festivities drew a large crowd to the west side of the campus to watch as USC President Steven B. Sample, Dean C. L. Max Nikias, former Dean Leonard Silverman and USC Trustee Ronald N. Tutor, for whom the building is named, cut an oversized red velvet sash with an equally oversized pair of scissors and welcomed a crowd of VIPs, guests, faculty, students and alumni inside for guided tours and refreshments.

"This is the new crown jewel of our complex," said Nikias. "It's a beautiful building, of course, but it's much more than that….Tutor Hall gives us a powerful new infrastructure for invention and an inspirational home for our students.

"It's our new 21st century accelerator!"

The 103,000-square-foot building — made possible with an initial $10-million gift from Tutor, president and chief executive officer of Tutor-Saliba Corp. — includes a vibrant new courtyard and student center for the USC Viterbi School of Engineering.

"This is the most special feeling that I can ever recall in terms of accomplishments, of being able to be part of giving a beautiful building to a university that so richly deserves it," said Tutor, whose construction company painstakingly built the hall.

USC President Sample was especially proud of the new hall.

"Winston Churchill once said, 'We shape our buildings, and they shape us,'" he said, beaming with pride at the front entrance to the building. "The architects of Tutor Hall have done an outstanding job of constructing not just a building, but an inspiring environment for our students and faculty who will shape the future of engineering at USC.

"Tutor Hall is many things," he continued. "It is an investment in the intellectual capital of our faculty and students; it's a bridge across academic disciplines, encouraging interdisciplinary research and teaching; it's a gathering place for students, creating a confluence of energy and ideas; and it's a magnet that will attract more world-class faculty, the best and brightest students from around the world, and increased research funding."

Romanesque Façade

Tutor Hall definitely has that collegiate look, as it is supposed to, said Yogesh Seth, an architect with A.C. Martin Partners, designers of the building. The hall sports a collegial Romanesque façade, blending attractive brick and banding details with concrete and sandstone walls. Large tinted glass windows on the north and south sides of the building offer occupants sweeping views of the cityscape and the Hollywood hills.

The main entrance looks a little bit like the

Music Center in downtown Los Angeles. A soaring two-story, open-air lobby features limestone and wooden-paneled walls, with marble accents and six sparkling Louis Poulsen "artichoke" chandeliers lighting the steps to the second floor. Directly off the impressive lobby on both the first and second floors are the centralized offices for undergraduate student affairs, the engineering mentoring program, distance education classrooms, the Center for Engineering Diversity, Women in Engineering and the student tutoring program.

For all of its physical beauty, though, Tutor Hall is much more than mere bricks and mortar. It is a new hub for student life and collaborative research at the Viterbi School and USC.

"We wanted to create a vibrant environment that complemented surrounding buildings but encouraged a great deal of interaction," Seth said. "The open-air courtyard spills into the lobby to facilitate chance meetings, interactivity and a collaborative atmosphere for the whole engineering community."

Adding to that ambiance is the second-floor student lounge — the Baum Student Center — named in recognition of a $2.5-million gift from the Baum family. The lounge "gives off the warmth of an indoor living room," Seth said.

"This is what it's really all about," said Dwight C. "Jim" Baum, chairman of the Viterbi School Board of Councilors, whose father, the late San Marino investment banker Dwight C. "Bill" Baum, first proposed the idea of building a student center. "Tutor Hall is a place for students to come together to relax, to socialize, to grab a bite, plug in their laptops and, most importantly, become a community."

The outdoor cyber café, fountain and reflecting pool create that sense of community. Tables and chairs, shaded by umbrellas, surround a cascading fountain made of stone and large whitewashed rocks, beckoning those who are strolling toward Vermont Avenue to stop in for a while.

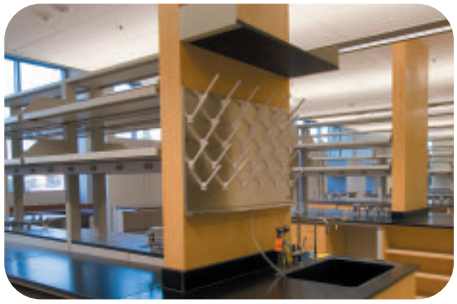
"We've turned the café into a cyber café with data ports so that students can sit in the courtyard on a pleasant day and plug in their laptops or just mingle with other students," said Richard Halfon, A.C. Martin Partners project manager. "It's not Starbucks, but it's the same idea. We gave them a first-class place to join the USC family."

"And it hums with the energy of a non-stop Viterbi student lifestyle," Nikias said.

Center for Cutting-Edge Research

Tutor Hall will be the center of cutting-edge research in three burgeoning fields: biomedical technology, information technology and nanotechnology. Dramatic advances in these fields are expected to produce breakthroughs in medicine and technologies to improve human health and welfare. Because they cannot be developed in isolation, the new facility was designed to bring faculty from many disciplines under one roof, encouraging synergy and creativity.

"Tutor Hall holds incomparable research facilities," Nikias emphasized, "centers where a shining future will emerge from revolutionary advances in information technology, biomedicine, robotics and nanotechnology."



"Tutor Hall holds incomparable research facilities, centers where a shining future will emerge from revolutionary advances in information technology, biomedicine, robotics and nanotechnology."

The nanotechnology laboratories are located in the basement. In addition to Class 1,000 and Class 10,000 clean rooms, the laboratories offer researchers all of the scientific accouterments necessary to perform nanoscale experiments: a flat slab gravity system to minimize vibrations, wet benches, dry benches, sinks and storage areas for chemicals and maximum ceiling lighting.

Student instructional labs are housed on

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Photos by Max S. Gerber

The Man Behind Tutor Hall

A visitor will recognize many of the museum-sized construction photographs adorning the hallways of Tutor-Saliba Corp. in Sylmar, Calif. They are reminders of the impact Ronald Tutor (BUAD '63) has had on some of California's most treasured landmarks.

Take a look at the beautifully restored and expanded Los Angeles Central Library, a marvel of Gothic and Hispanic designs, shaped like a pyramid with suns on each side of the building and a hand at the apex, holding the torch of knowledge.

Visit San Diego's glistening, transparent convention center, with its vaulted corridors of glass, airy exhibit halls and domical circulation bridges.

Cross over the north end of San Francisco Bay on the cantilever-truss Richmond-San Rafael Bridge, gateway to California's wine country for approximately 60,000 motorists a day.

They're all Tutor-Saliba projects.

Now the construction giant's name graces the north entrance of USC's newest engineering facility — Ronald Tutor Hall — the state-of-the-art instructional and research complex standing squarely in the center of USC's Viterbi School of Engineering. A panoramic view of the building isn't hanging on Tutor's office walls yet, but then the facility has just opened.

The six-story structure, made possible with a $10-million gift from Tutor himself, is another example of this man's zest for big projects. The building features a luxurious, open-air lobby which gives it the look and feel of the Dorothy Chandler Pavilion. State-of-the-art laboratories taking up two floors of the hall are expected to advance cutting-edge research in the hot new fields of biomedical technology, information technology and nanotechnology.

Better yet, engineering students finally have a place they can call home, with an attractive outdoor courtyard, cyber café and gently trickling pond and fountain. On the second floor, they can curl up for an hour of studying in the cozy Baum Student Center, or find inspiration in the Viterbi Museum *(see story about museum opening on page 14).* When push comes to shove, a host of student affairs offices are open to handle their every administrative need.

In its brief lifetime, oddly enough, Tutor Hall has already become a campus landmark.

Ronald Tutor

'Utterly Amazed'

Ron Tutor, a USC trustee who started out in engineering but switched to finance in his senior year, stood in "utter amazement" when he saw the building completed.

"It was awesome, very exciting," he says, sitting behind his large, polished desk at Tutor-Saliba Corp. headquarters. After a pause, he adds, "It's hard to describe."

He admits that Tutor Hall holds "a very special place" in his heart. What began as the whisper of an idea in 1984 is, today, a symbol of the excellence that USC brings to engineering.

Tutor's own Trojan roots go back a long way. He graduated from USC in 1963 with a bachelor's degree in finance, but had no idea what he wanted to do. His father, an owner-builder and developer with his own company, A.G. Tutor Co., offered him a job in construction while he figured it out. About a year later, the senior Tutor became very ill with cancer, putting 24-year-old Ron Tutor in charge of the business.

"I didn't like being a developer or an owner-builder, constantly courting money from third parties and investors, so I decided that I wanted to go after government contracts," Tutor says. "I started in 1965, doing very small jobs for the navy, the county and the L.A. Unified School District. That's how it all got started."

Tutor believed government contracts were the best way to succeed. He was right. Today Tutor-Saliba Corp. is one of the largest privately held general contracting firms in the United States, with more than $9 billion in completed work.

Tutor Meets Saliba

Until 1972, he ran his company alone, at which time he met Naseeb Saliba, an entrepreneur of Lebanese descent and owner of a successful heavy construction company, N.M. Saliba Co., on the West Coast. Saliba had retired early, at age 42, but came out of retirement to form a partnership with Tutor.

Tutor and Saliba took on some of the most notable public works projects in recent years, including the Tom Bradley International Airport Terminal, the Los Angeles Metro Rail system, the San Francisco Bay Area Rapid Transit (BART) railway system and the Alameda Corridor project in Los Angeles.

"At the time, the Alameda Corridor was the largest, most successful public works job built in the U.S., because it was a single

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Photo by Rich Marchewka

the ground floor. The labs are equipped with the latest audiovisual equipment, cameras and high-speed Internet interfaces to beam distance education classes around the world.

The multimedia laboratories, including the Viterbi School's Integrated Media Systems Center (IMSC), are the centerpiece of the second floor. Here, IMSC faculty are creating tomorrow's three-dimensional "immersidata" technologies for the Internet. The new Viterbi Museum, showcasing Andrew Viterbi's pioneering contributions to the birth and development of cellular communications, is also housed on the opposite side of the lobby staircase and will be open to all who visit the building. *(See story on Viterbi Museum opening on page 14)*

Spacious Upper Floors and Labs

The layout of laboratories and offices on the upper floors is spacious, according to Seth. All of the corridors have large picture windows to bring in natural lighting. The elevators face out from the interior "to give people a view and sense of orientation from each floor."

Electrical engineers will congregate on the third and fourth floors, where they have high-tech electronics and data laboratories to design, develop and test electrical and electronic equipment. The laboratories are flexible and easy to reconfigure to accommodate multiple users conducting different types of work. Both floors also house faculty offices and small, private meeting rooms for students and instructors.

One flight up, on the fifth floor, are the biotechnology laboratories and clean rooms, where researchers are developing tiny MEMS (microelectromechanical systems) machines using manufacturing techniques grounded in the integrated circuit industry. The labs are interspersed with faculty suites and additional meeting rooms.

Crowd Reaction

"What do you think of it?" Nikias asked the crowd, looking up at the building.

"Isn't it beautiful?"

Over the applause, he exclaimed, "It's all yours!"

Nikias called the building "a tangible symbol of our vision for the future of the USC Viterbi School of Engineering."

Lobby Staircase.

During the Viterbi School's current fundraising campaign to raise $300 million, donors and corporate sponsors will have opportunities to support student scholarships, student programs and services, tutoring and faculty research housed in the new building.

Tutor Hall is also an important part of USC's capital construction program, Sample told the audience.

"Over the next 10-to-11 years, we'll be building 28 new buildings at USC with over eight million square feet of new space," he said. "In essence, we're building a new campus, and it's exciting to see these plans become a reality, especially as USC marks the 125th anniversary of its founding in 1880."

Tutor Hall is now part of an engineering legacy at USC that began almost 100 years ago with a couple of students and a simple wood house.

Top; The dedication ceremony for Tutor Hall on February 2, 2005.

Bottom; Cutting the ribbon in a big way. Left to right, Leonard Silverman, Ron Tutor, President Sample and Dean Nikias.

Top photos by Rich Marchewka; bottom photos by Brian Morri

Photo by Brian Morri

contract built on a design-build basis," Tutor says. "We turned it over within three years of our original award, and that included design as well as construction of the $760-million, below-ground trench to put the railroad below Alameda."

The undertaking was monumental, but lauded as remarkable in scope. Overall, the corridor involved digging a 10-mile-long concrete trench underneath the city. Contractors used more than 1 million cubic yards of concrete, 25,000 piles, 29 bridges, and 62 miles of Class 1 railroad track.

In 1994, Tutor bought out Saliba's ownership in the company, the same year that a 6.9-magnitude earthquake ripped through Northridge, Calif., and brought him some new retrofitting projects.

San Francisco's Bridges

Seismic upgrading and rebuilding of five bridges in the San Francisco Bay area actually began in 1971, after a powerful 7.0-magnitude earthquake struck the San Fernando Valley. The urgency of the repair work grew in 1989, when a destructive quake caused bridges to collapse in Loma Prieta, near the San Francisco Bay area. But the Northridge quake — a 6.9-magnitude temblor — tipped the scales, mandating even more modifications to California's seismic standards and hastening the work.

"I think the Richmond-San Rafael Bridge retrofit job was probably the most technically challenging we'd ever seen," says Tutor. "A brand new bridge over water would have been easy. But we had to reinforce the foundations all the way through the piers, throughout the entire 5.5-mile-long frame, while we maintained traffic." Tutor-Saliba crews worked day and night around the flow of traffic as they rebuilt the $700-million seismic retrofit.

Tutor-Saliba supports a large staff of about 1,500 to 2,000 workers, including about 100 engineers, to do the work. Some of it is overseas work, done from offices in Manila, capital of the Philippines, as well as in Guam and Micronesia. At the same time, Tutor is chief executive officer of Perini Corp., a large civil works contractor that is also the largest builder of casinos and hotels in the United States.

"I have to say that 99 percent of what you learn in construction you learn on the job," Tutor says. "An undergraduate degree in civil engineering gives you a wonderful start in terms of discipline, a general knowledge of terminology, and an understanding of how things function, but it barely even scratches the surface when it comes to solving problems on the scale in which we work."

USC noticed Tutor's impressive portfolio long before the construction industry began to hand out awards. As the scope and scale of his projects grew, Anthony D. Lazarro (BSISE '49), senior vice president emeritus of business affairs at USC, approached Tutor and offered to introduce him to former Viterbi School Dean Leonard M. Silverman. It was the start of informal talks to build an engineering center that went on for 13 years with two deans.

In 1997, Tutor pledged $10-million to USC for the construction of a new building for the engineering school. He also began to draw on his experience to hammer out a blueprint for USC's long-range capital construction program. USC President Steven B. Sample said at the opening ceremonies for Tutor Hall that over the next 10 to 11 years, the university would construct 28 new buildings, adding eight million square feet of space to the campus. The Board of Trustees is relying on Tutor's guidance to help them through the ambitious construction program.

Contractor of the Year Award

Tutor has a list of awards almost as long as his abbreviated biography, but the one he's most proud of is the U.S. Army Corps of Engineers, which named him National Civil Works Construction Contractor of the Year in 1994 for his outlet/diversion work on the Seven Oaks Dam in San Bernardino County.

"Basically, we had the difficult job of building a rock tunnel and concrete intake channel in preparation for the construction of the Santa Ana River Mainstem Project, which was designed to provide flood protection to growing urban communities in Orange, Riverside and San Bernardino counties," he says.

The Army Corps of Engineers honored Tutor-Saliba Corp. in a celebration at its headquarters in Washington, D.C. for the "best performance" of all public works contractors in the country.

And for all of his work at USC, Tutor still relishes the award bestowed on him in 1991 – USC's Engineering Service Award.

"That was nice," he says. "I worked very hard for USC for a number of years and contributed significantly to the university's seismic testing program, as well as being part of the Viterbi School's outreach efforts in the late 1980s to educate the construction industry and its need for qualified engineers."

He set up tours for high school classes, showing them his subway projects in Los Angeles, and used outreach opportunities to get kids interested in engineering.

"Believe it or not, this was at a time when kids weren't coming to USC," he says.

Things have changed today. Enrollment in the Viterbi School is up and students are more interested in learning the trade. They also yearn to know Tutor's path to success.

"I'm not sure there really was a path," he says. "I tell kids if they're going to go into the construction industry, they'd better have an aggressive personality, very good personal discipline, and a capacity to work very hard, because no matter how smart they are, the business demands long hours and hard work."

Tutor's work is demanding and his hands-on style of management takes him frequently to construction sites from the tip of Southern California to the sands of Las Vegas, Nevada. But when he is in town, he enjoys spending time at his home in Hidden Hills, Calif., an equestrian community in the western San Fernando Valley.

He has five adult children — James, Tracy, Kristin, Darek and Skyler — but none of them have any plans to go into construction.

That doesn't faze Tutor. He'd just as soon be the only "hardhat" in the family.

Jim Baum

Remarks by Dwight J. "Jim" Baum on the occasion of the Opening of Ronald Tutor Hall

February 2, 2005

Thank you Max.

I am really glad to see so many students here today because that is really what this is all about. When my father and I first embarked on this journey with Len Silverman, longer ago than I care to remember, we did not know where it would lead. We knew the School needed a space for its students to come together — to relax, to socialize, to grab a bite, to plug in their laptops, and most important, to become a community.

But where to put it?

Time has passed, as has my father, but that dream has not. Over time it developed and with this wonderful gift from Ron Tutor, it has matured far beyond our initial plans.

On one of my first tours of the building site, a project manager who shall remain nameless for obvious reasons, said this building really has two front doors – one which the School and Mr. Tutor defines as the front, and one the students will call the front.

This structure in all of its architectural maturity has so much promise — its design flexibility will serve us in the years to come in ways we do not yet know. But at the same time it will always serve as the hub of student activity within the Viterbi School. For too long, engineering schools and certainly not just USC, have ignored the development of social and personal relationships in favor of academics and research. The promises of an engineering education are unlimited. Just look behind me at the distinguished gentlemen I am honored to be with here today. A university president who by any standard is a modern day Leonardo, a gifted and dynamic college dean, and a master builder — all of whom share the same background as you, an undergraduate engineering education. Do you need anymore proof that the arduous and difficult road you have chosen in your educational pursuit is worth it? With the tools and character you will gain here there are no limits to the career paths you can choose.

But as I and my father realized from our own educational experience and continually reinforced by my offspring as they attended USC — engineering schools seem to lack an identity within the larger university community — no feeling of belonging to a social unit, no place to meet and study in those all important homework groups, no place to organize a club, no place to drop in and have a quick word with your advisor, no place for a wake-up coffee.

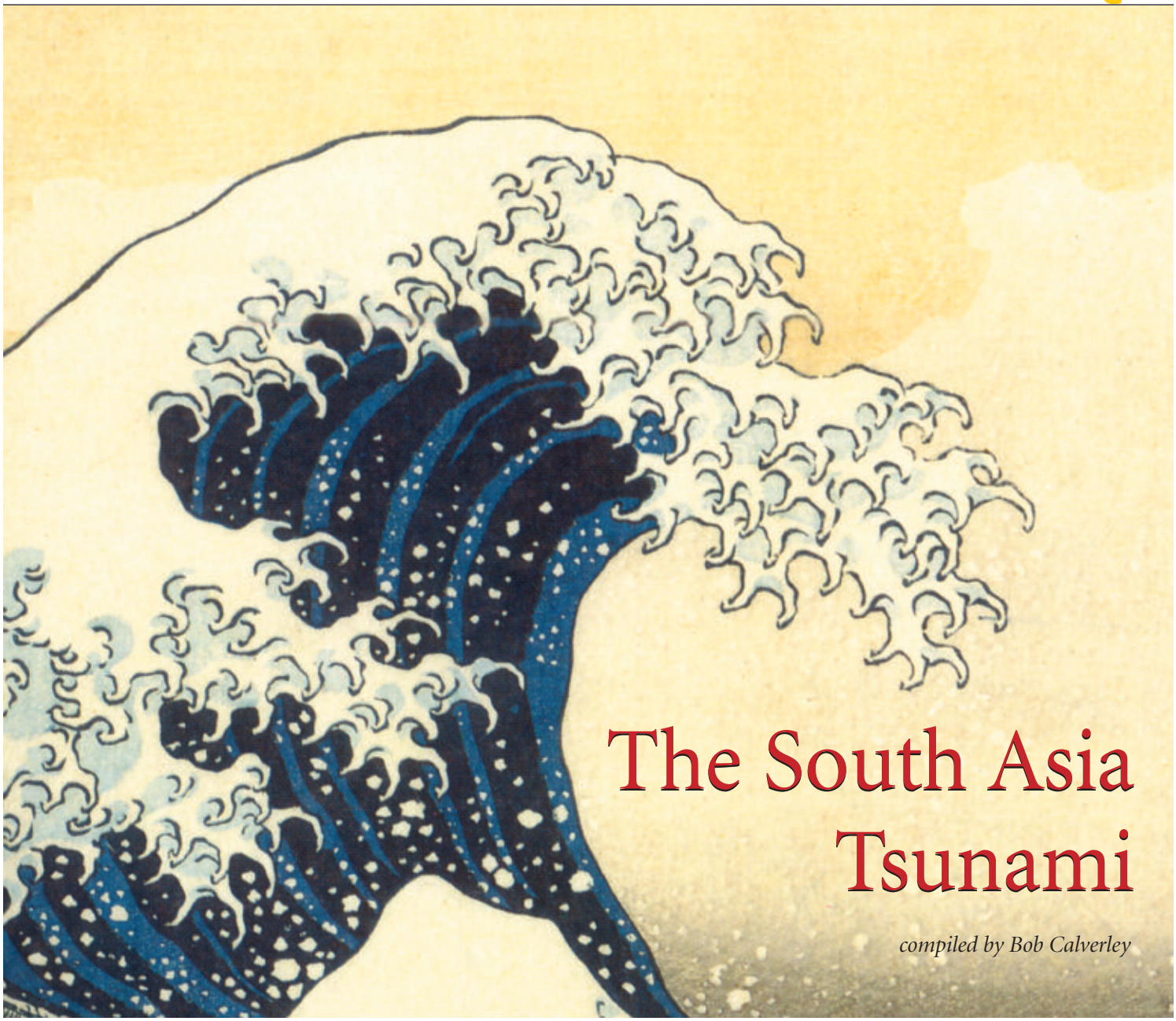
Today at least at USC engineering, that has changed. Thanks to this beautiful building Ron has built here, to the many other contributors who have made this possible and to the strong support of the administration, we have not only a great academic asset, but also a roof and a space for a new student world. A café, computer plug-ins, faculty advisor offices, and even I hear, videos like *Indiana Jones* to attract you. Whatever it takes!

Please use it and enjoy it. It is truly your space. If you have ideas on how to improve it, let us know. You are the bosses and I promise we will listen.

Meanwhile, you have the facilities, faculty and staff of a dynamic engineering school surrounded by a vibrant university. Take all you can from it. You will never be sorry you did not take an easier road.

Dwight J. "Jim" Baum is chair of the USC Viterbi School's Board of Councilors and president of Dwight C. Baum Investments founded by his father, the late Dwight C. "Bill" Baum. In 2000, the Baum family designated a $2.5 million gift to name the Baum Student Center in the new Ronald Tutor Hall.

Tutor Hall photos: top and detail by Rich Marchewka; bottom by Max S. Gerber and Baum photo by Brian Morri



The South Asia Tsunami

compiled by Bob Calverley

USC's Costas Synolakis, professor of civil engineering and director of the Viterbi School Tsunami Research Center, is one of the world's most distinguished experts on tsunamis. For years he and a small staff of USC tsunami experts have chased tsunamis across the globe, traveling to Alaska, Papua New Guinea, Java, Turkey and the Marquesas Islands to map the bottom of the ocean floor after a tsunami and gather survey data of the devastation.

Synolakis was in Athens, Greece, getting married, when the Indian Ocean tsunami struck on Dec. 26, 2004. His colleague, Jose Borrero, a research assistant professor of civil engineering, was in Florida helping a family member clean up from the recent hurricane damage.

Both dropped everything to fly to South Asia to conduct field studies. Borrero went to Banda Aceh, in northern Sumatra, with a National Geographic film crew — the only western scientist at the time to record tsunami data in the epicenter region. Synolakis joined another scientific team heading for Sri Lanka. Coincidentally, both researchers were bound for places ravaged by civil war in addition to the recent catastrophe.

During their work, the two found time to write their own articles — Synolakis for numerous publications, including the *Wall Street Journal, New York Times* and the *Times of London Higher Education Supplement* — and Borrero for *La Tribune,* a Canadian newspaper in Sherbrooke, Quebec. Both were interviewed by dozens of broadcast outlets in English, Spanish, French and Greek.

They were still overseas as this magazine went to press, gathering data and interviewing eyewitnesses to the worst tsunami in modern history. In the following articles, they show us the humanity of this disaster, how it could have happened and why no one had any warning. Synolakis raises a red flag at the West for having misguided research priorities; Borrero, one of the first U.S. scientists to arrive, simply walks us through the devastation.

Faculty Op-ed

Why There Was No Warning

by Costas Synolakis

The images from Sri Lanka, India and Thailand that filled our television screens in the aftermath of the horrific Asian tsunamis of Dec. 26, 2004 — and the descriptions from survivors — are sadly all too familiar, at least to those of us who have conducted tsunami field surveys. At times, some of us thought that we were revisiting images from Flores in 1992, or East Java in 1994, Irian Jaya in 1996, Papua New Guinea in 1998, or Vanuatu in 1999, to mention only the catastrophes that have occurred in countries with similar landscape and coastal construction.

The response of local residents and tourists to this tsunami, however, was unfamiliar, at least to tsunami field scientists who have been involved in post-'90s tsunamis. In one report, swimmers felt the current associated with the leading depression wave approaching the beach, yet hesitated about getting out of the water because of the "noise" and the fear that there was an earthquake and they would be safer away from buildings. They had to be told by tourists from Japan — a land where an understanding of tsunamis is now almost hard-wired in the genes — to run to high ground. In another report, vacationers spending the day on Phi Phi were taken back to Phuket one hour after the event started. In many cases tsunami waves persist for several hours, and the transport was nothing less than grossly irresponsible.

Contrast these reactions with what happened in Vanuatu in 1999. On Pentecost Island, a rather pristine enclave with no electricity or running water, the locals watch television once a week when a pick-up truck with a satellite dish, a VCR and a TV stops by each village. When the International Tsunami Survey Team visited days after the tsunami, they heard that the residents had watched a UNESCO video prepared the year before, in the aftermath of the 1998 Papua New Guinea tsunami disaster. When they felt the ground shake during the 1999 earthquake, they ran to a hill nearby. The tsunami swept through, leveling the village. Out of 500 people, only three died, and all three had

Synolakis photo by Brian Morri

Six Days in Banda Aceh
From Jose Borrero's Journal

Day One: January 3, 2005

Landing in Medan, on the northeast coast of Sumatra, I'm with a *National Geographic*-sponsored production company. They have done an incredible job of logistical support and planning for this trip. There are three vans waiting to meet us at the airport. There are about eight support guys, with full camping, cooking and survival gear. Our objective is to drive the coast road from Medan to Banda Aceh, the region hardest hit by the tsunami. I believe I will be the first scientist to get into the area, so I really owe these guys a lot for letting me tag along.

We got off the plane and Dan Cesareo, the *National Geographic* contact — who, as it turned out, was also a keen surfer with lots of experience in Indonesia — was in control of the logistics. He hustled us through customs and out to the waiting vans without a hitch. The rest of the production team consists of Jeff Swimmer, a TV producer from Santa Monica, Calif., and Jeff Streich, a cameraman from Portland, Oregon. The Indonesian team consists of Mustika from Bali, Jack from Medan, and two executive security guys from Jakarta, Gunawan and Zull. There were about five other guys whose names I never got, drivers, a cook and a mechanic. The *National Geographic* guys questioned the need for a mechanic, but for two vans and a bus traveling through an area with rebels and mountain roads, they were convinced it was a good idea.

Driving out of Medan took over an hour. The streets were loosely controlled chaos…absolute insanity. It looked like a disaster area, but the earthquake and tsunami were not even a factor here. I had only been to Indonesia once before, on a tsunami reconnaissance trip to Biak Island in Irian Jaya on the Pacific side of Indonesia, so I'd never experienced

Above; A U.S. Navy air crewman helicopter drops food, cookies and water to Indonesians in a village on the island of Sumatra several days after the disaster. U.S. Navy photo courtesy of photographer's Mate 3rd Class Jacob J. Kirk.

anything like this. There were cars and mini-bikes and scooters and three-wheeled carts all buzzing around inches from the window. There were nonstop cars, yet people were casually strolling across the street, as if they weren't about to get run over by a van full of TV guys on their way to a disaster zone.

We took the long bumpy beach road a few kilometers out to the coast. It definitely was a lot worse. The waves had come in about 500 meters, with a height of some two meters, and destroyed several of the poorly built, front-row houses. A prawn hatchery was on the front row, but the locals said the water didn't come up high enough to spill into the hatching tanks. I took data while the *National Geographic* team filmed. It took us a while; we didn't leave until almost dark. But we still had100 windy kilometers to go before reaching the town where we hoped to sleep.

Now, driving in Mexico is a bad idea…but here in northern Sumatra's Aceh Province, the problem was armed separatist rebels — and it was very real. We asked about the alleged cease-fire after the tsunami, but the locals laughed, as if to say, "yeah right…"

Fortunately, the stretch we had to cross was considered safe, so we went for it. No problems. We saw only one or two armed patrols of Indonesian army dudes, and every town had at least a few tanks, armored personnel carriers and machine gun nests on the side of the road. We made it to a hotel in Lhoksumave and crashed for the night. The bed, bucket shower and quasi-AC were exactly what my body and brain needed.

Day Two: January 4, 2005

We are awakened at 5:30 a.m. to news that the rebels had attacked a convoy in the mountains north of us, where we were planning to go. Apparently they were shot back by the Indonesian army. We loaded up, set up our gear for the day and were off by 6:30 a.m.

It was a long day of driving. The road was windy and went up and over some high mountains. It was rebel country.

Coming into Banda Aceh was surreal. It was sunny but hazy; a stiff wind was blowing dust everywhere. The first signs of catastrophe were some collapsed buildings, but given that it was a magnitude 9.0 earthquake, things looked okay.

As we got closer to the center of town, though, the disaster became more and more obvious — buildings down, cracks in walls. Then we got to the grand mosque. There were piles of debris left over from the tsunami and a thin layer of mud everywhere. Bulldozers were moving things around. The tower at the front of the grand mosque was cracked and leaning. The tsunami had deposited debris here at the mosque and we were miles from the open ocean. The words 'war zone' barely did the scene justice, but it wasn't even close to what I would see next and over the next few days. The wind was blowing hot, humid and dusty.

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We took the cars over to a riverfront area. The scene was truly mind-blowing. The wave simply unleashed on the entire city. I can't even imagine how it all went down…*everything was completely messed up.*

Boats were twisted and smashed and piled up on top of the bridge where we were standing. I couldn't stop saying, "Oh my god…" There were piles of debris 20- or 30-feet high; there were bodies in the piles, legs and arms sticking out. Based only on the smell, there had to be three bodies I didn't see for every one I did see.

I walked around with the *National Geographic* crew and tried to focus on taking data, flow depths, locations and building damage, but I was completely overwhelmed by the scale of the destruction. Every time we turned a corner I would see something else completely amazing. I'd

Top; Banda Aceh, on the western coast of northern Sumatra, was destroyed by the Dec. 26, 2004 tsunami. U.S. Navy photo courtesy of photographer's Mate 3rd Class Tyler J. Clements.

Middle; Trash and debris surround the bodies of deceased in downtown Banda Aceh, following the massive tsunami. Department of Defense photo courtesy of Michael L. Bak.

Bottom; An aerial view of the countryside south of Banda Aceh, viewed from an SH-60F Seahawk helicopter assigned to Helicopter Anti-Submarine Squadron Two (HS-2) "Golden Falcons." The squadron supported disaster relief teams and humanitarian airlifts to tsunami-stricken costal regions. U.S. Navy photo courtesy of photographer's Mate Airman Patrick M. Bonafede.

Faculty Op-ed

been unable to run like the others. The tsunami had hit at night.

The angry questions that hundreds of thousands of family members of victims are asking right now, especially in Sri Lanka and India, are the same: "What happened? Why did the tsunami hit? Why didn't anyone warn us?"

The answer, sadly enough, is that the danger was grossly underestimated.

The Pacific Tsunami Warning Center (PTWC) had issued a tsunami bulletin that day and concluded that there was no danger for the Pacific nations in its jurisdiction. It didn't extend its warning to South and Southeast Asia. It's clear with hindsight that an Indian Ocean tsunami warning center should have been in place, or that the Indian Ocean nations should have requested coverage from the PTWC. No one believed the earthquake packed that much energy deep beneath the Indian Ocean.

To give governments the benefit of the doubt, the last transoceanic tsunami to hit the region occurred in 1882; it was caused by Krakatoa's eruption. And other large earthquakes along the Sumatra trench had not caused major tsunamis, or if they had, they had not been reported as devastating. Floods occur nearly every year, as do storms. Natural hazards that are less frequent tend to be ignored. No nation can be ready for every eventuality — as this country's own 9/11 terrorist attack painfully demonstrated — at least before a major disaster identifies the risk. Without the governments of Indian Ocean nations to identify the risk, Pacific nations probably did not feel they needed the services of the PTWC. Even simple and inexpensive mitigation strategies, such as public education, were not in place. Sri Lanka's rapid tourist development may have had something to do with the government's inaction toward tsunami preparedness, but the governments of the developed nations should have known better.

The potential for these mega-thrust earthquakes has only begun to enter our national discourse and they still do not attract the attention they deserve. One of the problems is the priority of funding bodies. Any geophysicist working in the West knows how much easier it is to get funding to study hazards close to home rather than those abroad. One junior faculty member was once famously advised that he might not get tenure because he was only working on the obscure Anatolian fault. Weeks later, the fault ruptured, causing the 1999 Izmit earthquake (and tsunami) that killed more than 17,000 people.

The United States' National Science Foundation budget for tsunami hazard mitigation is dwarfed by the research budget it has devoted to fluid dynamics research, with all of its potential military applications. The ocean floor remains largely uncharted, leaving hazard zones unidentified, and is less familiar to scientists than the surface of Venus. One brilliant Indian scientist working on the generation of tsunamis left the field to focus on

see a pile of debris and it would take me a few minutes to realize that there was a boat on top of it and a body at the bottom.

The big support van had gone ahead and set up camp in Banda Aceh. The only place to sleep was out on the grass at the Governor's compound. The place was totally surreal. Chaos. This was where all the journalists were staying. All the big news guys were there: *CNN, CBS, Fox.*

The support crew cooked dinner for us. We slept comfortably in tents, unlike the thousands of displaced people scattered in refugee camps around the area. Sometime during that first night a big aftershock hit. I heard people yelling "earthquake!" I think I woke up for a minute or two and saw one of the *National Geographic* guys with his head outside the tent. The next day we noticed that there was a large heavy TV antenna mounted on a 10-foot pole, stuck loosely in the planter box that was above our tent.

Day Three: January 5, 2005

We spent the morning touring Banda Aceh, walking the town as far out toward the sea as we could. I walked with Gunawan, our local Indonesian security expert. We walked from the river area to the north toward the open ocean.

It was so unreal, a beautiful sunny tropical day in Sumatra, and we're walking through a place that used to be full of life, a complete city that was now nothing more than rubble. One house in 20 was still partially standing. I went to each semi-intact house and took a GPS location and tried to measure a flow depth by looking for the mud marks on the walls, three meters, four meters, five meters…the numbers kept getting higher as we got closer to the ocean. Every once in a while a dead body would surprise me.

We walked back to where the *National Geographic* guys were filming, and a squad of Indonesian soldiers showed up and started pulling more bodies out of the rubble. I only saw one or two, but within a half hour they had a pile of no-longer-empty body bags.

Later that afternoon I was able to sneak off with Jack, the Sumatran

Above; Quake-triggered tidal waves hit Kammale temple in Phuket, about 536 miles south of Bangkok. Heavy rains and fresh floods later disrupted deliveries of food and medical supplies to Asia's tsunami-stricken villages. REUTERS photo.

tour guide from Medan who worked for the tour company that set up the travel logistics, and Gunawan, our Indonesian security guard, with one of the vans and drivers. We headed west to see the tsunami effects on the open Indian Ocean side of Sumatra, the area directly facing the epicenter of the earthquake. The waves should have been much bigger out there.

The very first bridge we came to over a medium-sized river was about 300 yards from the sea and completely blown apart. The remnants of the concrete and steel decking were pushed upstream about 20 yards. There was another body floating face down — bloated with legs spread apart — in some of the debris.

The locals had constructed a crude platform raft from empty oil barrels and wooden planks, and we pulled ourselves across. I walked up the small rise on the other side and saw a jetty in the distance with a freighter overturned on its side. It looked to be quite a ways away, but after asking a local who said it was only "one kilometer," we decided to try and walk as far as we could.

The views were amazing. It was hard to tell what had been there before, but there was nothing there now. It looked like there used to be a town here. There were a bunch of foundations and wall sections scattered on the ground. Huge Australian pine trees had been uprooted and tossed around. The ones that were still standing had the bark uniformly stripped off to a level well above the five-meter staff that I was using. I measured the stripped-off bark on one tree that was knocked over and it was over 10 meters from the roots. This indicated that the water was flowing at least 10 meters (33 feet!) deep at the shoreline.

We kept walking south along the beach until we came to a cement factory built up on the beach. There was a steep hill behind the factory and it was obvious that the wave had swept through the factory. An oil storage tank was crumpled and tilted to the side. There were some people who were running a relief shelter to help transport the injured from one of the more distant villages. One of the guys there told me that a navigational buoy three kilometers offshore had been ripped from its mooring and deposited in the factory. He said you could see the light flashing at night.

I planned to come back the next day to get an accurate measurement on the run-up line with better equipment, but that turned out to be a mistake.

Day Four: January 6, 2005

Today I headed east with Gunawan and the driver toward a small port and oil transfer facility some 45 kilometers away. I was able to survey the port and one location along the way. All along I was taking GPS locations and photographs. On the way back I stepped out to take a photo of a demolished house and nearly tripped over a dead body wrapped in plastic. This was an outlying area of Banda Aceh and the clean-up crews had not come through yet. I noticed that the number of bodies on the side of the road had tripled in the hours since we drove past this area on the way out to the port.

We were running a bit late to meet up with the *National Geographic* guys, but we found them waiting in the van on the side of the road. They flagged us down and gave me the story:

While waiting at the ferry crossing over the river they heard gunfire; a squad of Indonesian army guys had engaged some Acehnese rebels and were sweeping up the beach. By the time I caught up with them, they looked pretty shaken up.

The rest of the afternoon was spent out at the waterfront. I was concerned that I wouldn't have enough data points to make a decent report or paper and the prospect of getting out on the west looked bleak. The bridges were all out and the rebels were blocking access to my data! My only hope was to hop a flight on one of the U.S. Navy relief helicopters the next morning.

We had dinner, went

Top; Women in Banda Aceh, appear hopeful as U.S. military helicopters arrive with food and medical supplies. U.S. Navy photo courtesy of photographer's Mate 3rd Class Tyler J. Clements.

Middle; A resident of Meulaboh, picks through the debris of city streets, looking for personal possessions. U.S. Navy photo courtesy of photographer's Mate 3rd Class Jennifer Rivera.

Bottom; Tsunami victims receive medical attention from U.S. Navy medical personnel and aid workers at Sultan Iskandar Muda Air Force Base in Banda Aceh. U.S. Navy photo courtesy of photographer's Mate 3rd Class Benjamin D. Glass.

Faculty Op-ed

more marketable studies in defense-related fluid mechanics. In the U.S. and the U.K., geology, geophysics and coastal engineering have tended to attract the smallest numbers of graduate students. In the U.S., only one new faculty position in tsunami hydrodynamics has been added in more than 20 years.

Nature and *Science* have published less than a handful of original articles on tsunamis in the past five years. Students perceive quickly what most working scientists know: the national priorities of developed countries drive international research and educational agendas. Market forces mean that only elite universities train students to think outside current paradigms. The market discourages original thinking to maximize productivity; innovation is encouraged, initiative is not. How can anyone blame PTWC scientists for following intergovernmental agreements and ignoring any attempt to determine if a tsunami risk existed beyond their jurisdictions?

International research and education priorities must reflect the reality that no nation is immune in an era of global citizenship. Globalization must extend beyond free trade. The U.N. Intergovernmental Oceanographic Commission must continue its efforts to develop a long-term approach to tsunami hazard mitigation through a coordinated program involving assessment, warning guidance and mitigation for communities at risk. Extensive studies to map the seafloor at high resolution, improved numerical wave-propagation models, new studies to document prehistoric tsunamis and the deployment of tsunameters will help to identify risk zones, monitor occurrences and develop inundation maps to guide evacuation plans. Indian Ocean scientists, disaster managers, policymakers and local communities need to work together to create tsunami-resistant communities with access to accurate warnings.

A warning center should be established as soon as is practicable in this region — and Indian Ocean nations need to ask the PTWC to act as an interim warning center. Many developing countries do not have the resources to do this and will need assistance. Even among Pacific Rim nations, only three have comprehensive inundation maps, and none has maps charting the probability of tsunami flooding that reflect the realities of the past 30 years.

This last tsunami killed more people than all of the 20th-century tsunamis combined. It's important that all organizations and nations with know-how in hazard mitigation help implement the U.N.'s global plan before the next tsunami strikes.

For a comprehensive listing of tsunami researcher's news coverage, please visit us at: http://viterbi.usc.edu/news/inthenews/2004/2004_12_30_ tsunami_stories.htm

For the USC Tsunami Research Center home page, see http://www.usc.edu/dept/tsunamis/2005/index.html

to bed, and I slept through another 6.0-magnitude earthquake that night.

Day Five: January 7, 2005

I was up early, 5 a.m. I was pacing around the camp, trying to figure out the best way to get good data. Without at least one more data point on the west coast, the "scientific" part of this trip would be rather weak.

Luck was on my side this day. We made it to the airport at about 7:30 a.m. There were already flights going in and out, taking food and water to cut-off villages. I checked in with a U.S. military guy and he directed me to the person in charge of getting journalists on the helicopter flights.

We were up and flying by 8:15 a.m., shooting south along the coast and over the devastated areas of Banda Aceh. From the air, the effects were much clearer and you were able to really see the scale of the disaster that could not be appreciated from ground level.

All along the west coast, a neat trim line was clearly evident. It was obvious how high the wave had come — I could see the rocks and dirt exposed where previously there had been a dense coastal jungle. I estimated that the run-up all along this coast was 10-to-15 meters.

We spent the rest of the day shooting GPS points and flow marks on the eastern side of Banda Aceh.

Day Six: January 8, 2005

This was it. We had arranged for a flight out of Medan. We packed up quickly and split up in two groups. I went to survey and measure some final locations to the west of Banda Aceh. The TV crew went to finish a story at the refugee camp. We were to meet at the airport at 10:30 a.m. for a 12:30 p.m. flight. On the way to the airport, I passed by a group of elephants that were being used to help clear debris. The *National Geographic* crew had filmed them earlier in the trip pulling a car out of the mud.

The airport was quite hectic and the flight to Jakarta was delayed about three hours, but it finally took off. We arrived in Jakarta at mid-night. That whole time I couldn't get the people in the refugee camps out of my mind. They had lost everything…how incredibly lucky we were.

Above; A village near the coast of Sumatra lays in ruin after the tsunami that struck South East Asia. U.S. Navy photo courtesy photographer's Mate 2nd Class Philip A. McDaniel.

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Joe Bok, BSAE '85

Making Howard Hughes' Airplanes Fly Again in *The Aviator*

How many people do you know who have founded two companies, earned two engineering degrees from USC, played Trojan football and have shaken hands with Leonardo DiCaprio?

Meet Joe Bok.

Bok's special effect company, Aero F/X Inc., a spin-off of his Aero Telemetry Corporation, created the large-scale models of Howard Hughes' airplanes used in Martin Scorsese's film *The Aviator*. The models—including the XF-11 with a 30-foot wingspan, the H-4 Spruce Goose with a 25-foot wingspan and the 18-foot wingspan H-1 Racer—all fly in the film, and that's where he met stars like DiCaprio.

"My first day on set started around 5:30 a.m. I needed to inspect the runway we would fly from. The studio had bulldozed it for us the night before. As I walked along the runway, I had a chance to look at the full-size, non-flyable mockup of the H-1 Racer parked to one side.

"I was under the plane looking at the landing gear, and someone inadvertently stepped on my boot. I pulled away and stood up thinking, 'Who could this be?' As the person turned around, I stumbled back and nearly fainted from fright—I thought I was seeing a ghost of Howard Hughes himself."

Bok quickly collected himself, to discover he stood face to face with Leonardo DiCaprio. "He was in full makeup, coming over to get ready for his shot in the cockpit of the H-1. Since there was no one else around, he was startled to find someone under the airplane. We introduced ourselves and spoke briefly."

The large models lend realism to the film's crucial action scenes.

"There is still something about a computer-generated shot of a flying airplane or helicopter that just looks like a cartoon," says Bok. "Real airplanes have an asynchronous motion about them that our brains recognize as 'real.'"

Bok understood the stakes involved in his work. "We used every ounce of engineering muscle we could bring to bear on *The Aviator* project to make sure that each and every one of our planes flew safely and came home in one piece. There was a tremendous amount of pressure on us. Someone could have been killed if we had calculated wrong."

Bok's work on *The Aviator* has opened other doors in the entertainment industry. "We are producing a nine-part series called *The Aviators* for cable television. It chronicles the amazing real life drama and story of the Howard Hughes airplanes we built."

Before Aero F/X, Bok started Aero Telemetry Corporation, which specializes in the design and manufacture of unmanned air vehicles and airborne satellite communication systems, used both commercially and by the military.

The creation of his company—as with most of life's biggest events—involved considerable serendipity. "In the 1990s I decided to get a pilot's license," Bok recalls. "I liked flying so much that I decided to learn how to fly old World War II airplanes and maybe even race them at the Reno National Air Race Championships."

In flying, he discovered a need for a wireless method of transferring electronic data from the airplane to the crew chief on the ground. "This would allow a person on the ground to manipulate some of the engine tuning controls and would free me up so I could concentrate on flying the airplane."

With this goal in mind, Bok quickly set to work, collaborating with classmate Greg Petrisor (BSEE '86, MSEE '87 and PhD EE '96). "He and I came up with a very compact and integrated design for a telemetry system that became the basis for all of our other designs at Aero Telemetry Corporation."

From there, things grew quickly. "My first order came from TRW, and I was off to the races after that."

The company subsequently branched out into supporting products for the U.S. military's unmanned air vehicles (UAV), including telemetry receivers, communications repeater systems and satellite transponders. Today their products can be found on almost every major UAV project in the world.

Joe Bok with his model airplanes used in the film, The Aviator.

Working both for the military and for Hollywood, Bok splits his time between Washington, D.C. and Los Angeles. Despite a jammed schedule, he manages to volunteer for charitable organizations, from Athletes and Entertainers for Kids to USC's Swim with Mike.

His professional success has its roots at USC, where he earned a B.S. in aerospace engineering in 1985. He was an inside linebacker on the football team and cites Artie Gigantino, his well-known linebacker coach, as a key mentor.

"A great coach like Artie could see my mistakes and help me understand how to

Photo by Eugene Garcia

change. As a player you need to be open-minded enough to know your coach is there to help you become the best you can be," says Bok. "In business and in life, it's the same way, you have to change to remain competitive. I've always respected and encouraged the helpful criticism of people I knew were more intelligent than I was about a particular subject."

This mindset has surely helped Bok succeed. "It works like a charm," he quickly adds.

What else does he remember about his undergraduate experience?

Giving it more thought, he recalls the challenge of juggling football practice with the rigors of engineering classes. "My junior year we were ranked the number one team in the country—with the number one rush defense!—coming off the 1985 Rose Bowl victory against Ohio State, 20-17. So, there was a lot of pressure on the team and players in practice, especially in spring training and summer camp."

Bok remains an avid fan of Trojan football. "I had the opportunity to stand on the sidelines for the USC-Notre Dame game for the past few years," he says, his pride apparent in his tone. "I couldn't help but remember what it was like to be down on the field as a linebacker getting ready for what was always one of the biggest games of the season. The Coliseum still has that effect on me."

Bok watched USC claim the most recent National Championship title from his home. "The game was very personal to me," he says. "I knew we had a lot at stake. I didn't sit down once until about the middle of the third quarter."

In the late 1990s, when Bok returned to campus for an M.S. in Engineering Management, he had already started his own company. "I got to a certain point in my professional career when I decided that I really needed more information on how to run a rapidly growing business."

He was able to apply what he learned right away. "I remember taking coursework from Dr. (Ann) Ehringer's class and going back into the boardroom with it. As the CEO, I could implement these new processes and see the results within just a few months. It was exhilarating."

His education has served him well over the years. Armed with his experiences in the classroom and the lessons he learned on the football field, Bok has certainly seen his career take flight.

And now he's seen the stars.

For additional information, please visit: Aero Telemetry Corp. http://www.aerotelemetry.com/; Orange County Register story on Joe Bok http://www.ocregister.com/ocr/2005/02/27/sections/entertainment/entertainment/article_421675.php; CNBC-TV story on Joe Bok http://www.msnbc.msn.com/id/7025938/

—Christian Camozzi

This page clockwise from top left; Bok and his crew prepare the model of the H-1 racer. The real H-1 set a world speed record in 1935, photo courtesy of Aero Telemetry Corporation; Leonardo DiCaprio in the full-size mockup of the H-1 racer. Photo by Andrew Cooper, photo courtesy of Miramax Films; Howard Hughes' Spruce Goose flies in Long Beach once again. Bok's model built for The Aviator *had a 25-foot wingspan, photo courtesy of Aero Telemetry Corporation and on* The Aviator *set, Bok controls one of the models used in the movie, photo courtesy of Aero Telemetry Corporation.*

Frank Flores, BSEE '78 *Visioneering Pays Off*

Northrop vice president is eager to put engineers on his path.

Frank Flores already has decorated his new El Segundo office with family photos, models of military aircraft and other mementoes of his previous job.

Flores is back in the South Bay, his old stomping grounds where he began his career as an engineer. He's also a half-hour drive from the Pico Rivera neighborhood where he grew up, never imagining he could attend college.

On Oct. 18, [2004] Flores started his new job as vice president of engineering, logistics and technology for the Air Combat Systems business area at Northrop Grumman Integrated Systems in El Segundo. That's the part of Northrop Grumman that builds the center fuselage of the F/A-18 Super Hornet and is developing part of the F-35 Joint Strike Fighter.

Flores, 48, oversees more than 3,000 employees in California and other states. His duties include assembling the engineering talent and resources needed in the company's programs.

"Anytime you get to a certain level in an organization, you fail if you try to do all the work yourself," Flores said while sitting at a side table in his office. "So, you have to set that vision of what everyone is trying to accomplish and get everyone on board. I consider that to be my strength, to motivate people."

Flores' road to vice president took a meaningful turn in the seventh grade. A math teacher took Flores and other students on a field trip to USC.

Flores, the grandson of Mexican immigrants, had no relatives who had gone to college. None of his friends' parents had college experience, he said. He couldn't imagine going either.

"We thought there's no way we could ever go to this school," Flores recalled. "This is for the rich people."

But the trip "planted a seed." Over time, something "just clicked in my head that maybe this college thing can work for me," he said.

Six years later, Flores was a USC freshman. He earned a bachelor's degree in electrical engineering in 1978. Then he landed a job at TRW Space and Electronics in Redondo Beach, which later became Northrop Grumman Space Technology.

He earned his master's degree in electrical engineering from USC while working at TRW.

Flores says he learned a lifelong lesson about motivation in his early years at TRW. At age 24, he was put in charge of a team testing how enemy jamming could affect a satellite's communication payload.

"I made sure every 'I' was dotted and every 'T' was crossed," Flores said. "I reviewed everything in excruciating detail to make sure no stone was unturned. I think about that when we give tasks to young engineers. They'll step up to the plate because they want to do well."

Flores eventually moved with about 100 other TRW employees to form a new business division in San Diego. He worked on radio technology for aircraft, and eventually became director of a program developing radio systems for the F-35.

"He is the ultimate team player," said Dick Croxall, vice president for mission assurance and chief engineer at Northrop Grumman Space Technology in Redondo Beach.

Croxall, who has worked on various projects with Flores over the years, described him as a "broad thinker" with strong technical and interpersonal skills.

"When he's committed to something, he goes into it with more than everything," Croxall said. "He doesn't just show up to beat up on people or to be part of the crowd on a Saturday or Sunday. That kind of goes back to why he's a go-to person. He will stay till the cows come home."

Flores gives several reasons for becoming an engineer. He was good in math and science as a high school student, and engineering seemed like a natural fit.

His father, Jose Jr., was an air conditioning serviceman, which fascinated Flores.

"It was just the whole aspect of how that control system worked. I just found it real interesting," Flores said. "He had a good understanding of thermal dynamics. And even when I got into college, I could come to him for help on thermal dynamic systems."

High school counselors encouraged Flores to pursue engineering because of the field's relative equality of opportunity, he said.

"High school advisers told me engineering is one of the most fair professions, where you get judged by your work instead of other social factors," Flores said. "That was in the early 1970s. If you looked, in general, across society

continued on page 44

Flores mentoring Jimmy Chan in mathematics at Lennox Middle School. He volunteers with other members of Adelante, a Hispanic and Latino employee network at Northrop Grumman, which helps mentor young students in math and science once a week during their lunch hour.

Ming Hsieh, BSEE '83, MSEE '84 *Helping to Secure the Future*

We can all sleep more soundly tonight thanks to Ming Hsieh (BSEE '83, MSEE '84), and the company he founded. Cogent Systems, Inc. is a leading provider of automated fingerprint identification systems that enable government and law enforcement agencies to match an individual fingerprint with millions of prints that are stored in databases across the nation — and even the world — in mere seconds. The company's Live-ID system is used by the U.S. Department of Homeland Security to screen foreign visitors against databases of terrorists, criminals, smugglers and immigration violators. All 47 law enforcement agencies in Los Angeles County rely on Cogent's specially designed biometric fingerprint identification system, which is fully integrated with state and national databases.

Computerized fingerprint identification was a specialized and somewhat limited field when Hsieh launched Cogent in 1990. "The three large companies that were our main competition had saturated the market," he explains. "But they limited themselves to semi-automated systems. I knew that if we could create a fully automated system, eventually incorporating web technology, we'd be successful."

Hsieh's research and development team at corporate headquarters in South Pasadena, headed by Xian Tang (MSEE '85) incorporated advanced concepts in fluid dynamics, neural networks, image enhancement, data mining and massively parallel processing into the company's proprietary software algorithms and optimized hardware, to produce cost-effective, accurate and extremely fast fingerprint identification systems. This enables Cogent's customers to capture fingerprint images electronically, encode fingerprints into searchable files and accurately compare a set of fingerprints to a database containing potentially millions of fingerprints in seconds.

Today, the U.S. Department of Homeland Security is the company's largest customer. To select the vendor for their US VISIT screening program, Hsieh recalls, "The DHS gave bidders an eight-second limit to capture two fingerprints from a traveler, check those against existing watch lists, deliver a match if available, and add the traveler's prints to a separate database for future tracking. We executed in four seconds — half the time — and won the business."

Other recent projects include a real-time voter verification system that was used during national elections in Venezuela in 2004; an automated fingerprint identification system for the 43 police forces of England and Wales, including New Scotland Yard; and a digital smart identity card program for the Hong Kong Immigration Department. The company's technology also played a role in identifying the suspects in the notorious Washington, D.C. sniper case in 2003.

The man behind these achievements hails from a rural community in China. "I grew up in a very poor family," Hsieh says. "My childhood was spent studying hard at school during the day and working on the family farm at night. There was very little opportunity for advancement for the people of my generation, in my community. During high school, I was given a few old transistors to play with and I was immediately fascinated. I spent all my spare time learning the ins and outs of these devices, and soon began building primitive radios and even televisions from scratch."

"It was fascinating to see how these basic building blocks could come together to create something as magical as a radio signal or a TV picture," he adds. "My parents saw how excited I was with these new toys, and they let me work less on the farm and spend more time learning about technology. This inspired me to seek an engineering education in the United States."

With the encouragement of his uncle, P. Y. Hsieh (MSME '52), Ming came to USC and the engineering school as an undergraduate. "My course in computer programming was the first time I was exposed to this subject," Hsieh says. "It opened my eyes to learn what a computer could do. But I remember being frustrated doing my homework because those computers were so slow." He also recalls being impressed by the number of engineering graduates who went on to form their own successful companies. "USC is where I learned about entrepreneurship," he says.

Ming Hsieh, chairman, president and CEO of Cogent Systems (fourth from right) joins NASDAQ host Bruce Aust and the Cogent senior staff to celebrate Cogent Systems listing on the NASDAQ National Market last fall.

After USC, Hsieh began working as a research and development engineer at International Rectifier. In 1987, he joined a couple of USC engineering classmates who had been designing ASIC chips for TRW, Jason Lo (BSEE '83) and Jonathan Jiang, to start a new company, AMAX Technology. Before long, however, Hsieh realized that in addition to simply developing software and hardware, a successful company needed products to bolster its bottom line.

"People had asked us if we could put thousands of fingerprints on a computer chip," he recalls, "but it just wasn't possible. However,

continued on page 44

Frank Flores *continued from page 42*

in the early 1970s, you still didn't see a large influx of people of color or women in the higher professions."

In 1991, while working in San Diego, Flores started a program to encourage school children in lower-economic areas to appreciate math and science. Dubbed KIDS, for Kids and Industry Discovering Science, the program would regularly send Flores and his engineering colleagues at TRW — which later became Northrop Grumman — into third-, fourth- and fifth-grade classrooms to teach math or science.

A member of the Society of Hispanic Professional Engineers, Flores has also visited minority engineering students at San Diego universities to speak about real-world applications.

Flores likes to unwind with his family, which includes three adult children from a previous marriage, his current wife, Megan, and a stepdaughter. Flores sometimes takes his 23-foot Maxum power boat to Catalina. He also likes to fish. He gave up water skiing after tearing a hamstring two years ago. He's thinking of getting back into it. Flores, who owns a house in Vista, near San Diego, lives alone in a Redondo Beach apartment. After his stepdaughter graduates from high school in June, she and his wife will join Flores in the South Bay.

Meanwhile, Flores will help hire 700 engineers for growing programs including the F-35. He looks forward to working with young engineers. "We'll give them opportunities and really stretch them," Flores said.

—Muhammed El-Hasan

Copywrite 2005, The Daily Breeze

Flores with Brandi Henry (BS CECS '02), an application developer at Northrop and a USC graduate. Brandi accompanied Frank throughout his typical work day as part of the company's Executive for a Day program. The monthly program provides staff members with an opportunity to observe and participate in meetings and events with top leadership, and enables Frank to get better acquainted with some of his 4,000 staff members.

Ming Hsieh *continued from page 43*

I realized the commercial possibilities if we could design software and hardware that would allow faster searches of existing fingerprint databases." From this realization, Cogent Systems was born.

"We signed our first contract six months after we started Cogent," Hsieh recalls. "It was a four-year, $16 million contract to develop identification systems for welfare fraud prevention. After the system was on-line, our clients were able to recover their full investment in the first six-months of operations. They were happy with the results."

Fourteen years and many breakthroughs later, Hsieh decided to take the company public. Last September, Cogent completed an IPO of 18 million shares, with underwriters exercising their full over-allotment option for an additional 2.7 million shares. The stock price gained nearly 50% over its opening price on the first day of trading — one of the best opening day performances of 2004.

"Going through the initial public offering for Cogent was a tremendous experience," says Hsieh. "It symbolized that we had finally been able to build a company that not only was delivering value to our customers and partners, but was also a company that had the ability to deliver value on an ongoing basis to public shareholders. It meant that all the hard work that my team had put into product development, writing proposals, winning customers over and implementing solutions has paid off, and it was an incredibly exciting and rewarding feeling to come back from the IPO and see the faces of our employees — some with tears, some with smiles, but all with a tremendous feeling of accomplishment."

Looking forward, Hsieh sees a bright future for biometrics. "We recently entered into a partnership with ANP Technologies, Inc., founded by Ray Yin (who got his Ph.D. in Chemistry from USC), to develop a low-cost biological detection system that rapidly cuts down the response time for detecting biological agents," he says.

But his vision for Cogent encompasses far more than just homeland security. "Positive identification of individuals is an essential social requirement," he notes. "As more interactions take place electronically, it becomes even more important to have an electronic verification of a person's identity. I believe that we as a company have contributed to a safer society, and in the future we will enable society to use biometrics in everyday life, making normal activities like traveling or shopping more efficient and enjoyable for everyone."

—Meredith Goodwin

mark your calendar!

Scheduled Events for Spring and Summer 2004

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

Trojan Founders Circle Luncheon
April 28, 2005
11:00 am
Town and Gown
USC Campus

USC Baccalaureate Ceremony
May 12, 2005
5:00 pm
Bovard Auditorium
USC Campus

2003 Commencement
May 13, 2005
University Ceremony
9:00 am
Alumni Memorial Park

Viterbi School of Engineering Ceremonies
Archimedes Plaza
10:30 am Undergraduate Ceremony
2:30 pm Graduate Ceremony
Receptions will immediately follow the ceremonies

Los Angeles County Infrastructure Report Card
Thursday October 27, 2005
7:30 am to 12:30 pm
Embassy Room
Davidson Conference Center
USC Campus

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

All aboard the USS Midway

for a private evening with the USC Viterbi School of Engineering

Thursday, June 9, 2005

6:30 to 9:30 p.m.

6:30 p.m. reception and supper
7:15 p.m. Midway Magic presentation by author Scott McGaugh
7:30 p.m. docent guided tours

San Diego Aircraft Carrier Museum
910 N. Harbor Drive, San Diego

Call Kirstin Strickland, director of alumni relations, at 213/740-4879, to make your reservation. Cost is $20 per person.

Casual attire and comfortable walking shoes are recommended. Authentic Navy flight simulators will be available for those who want to experience flying Mach Combat jets.

See www.midway.org for more information on the USS Midway.

snapshots

USC Viterbi School of Engineering Events
Winter & Spring 2005

Daniel Chang and Dean Nikias

Derek Hazeur of Microsoft speaks with an undergraduate engineering student.

Presenters and guests, including Andrew Viterbi (front row, fourth from left), pose after a day of stimulating presentations and lively discussion.

DEANS SEMINAR IN ENTREPRENEURSHIP

President and CEO of AEM, Inc., Daniel Chang (MSMS 95), and Dean Nikias enjoyed time together while Daniel was on campus to share his perspective with students in the Deans Seminar in Entrepreneurship in early February. The course is co-taught by Len Silverman, former dean of engineering, and Jack Borsting, former dean of business. Speakers are used to help students understand the elusive entrepreneurial spirit, and to give them insight on the skills and attitudes they must possess to start new ventures of their own.

ENGINEERING CAREER FAIR

Viterbi Career Services and Student Affairs hosted another successful Engineering Career Fair on February 24. Over 50 companies, industry alumni representatives and thousands of students took part in the one-day fair which is the central event of National Engineers Week at USC. The spring 2005 Engineering Career Fair highlighted the School's industrial and systems engineering program. Volunteers from the industrial engineering student organization assisted employers throughout the day. Contacts made during the event often lead to jobs after graduation.

2005 VITERBI CONFERENCE: ADVANCING TECHNOLOGY THROUGH COMMUNICATIONS SCIENCES

Sponsored by Qualcomm, the first Viterbi Conference was held at USC on March 8 and 9. The technical symposium featured fifteen distinguished speakers from areas of research in which Dr. Andrew Viterbi has made a significant impact. The speakers provided a mixture of technical, historical and anecdotal material. The first day of the Conference culminated with the 2005 Viterbi Lecture.

Presenter of the 2005 Viterbi Lecture, Jacob Ziv.

2005 VITERBI LECTURE

On the evening of March 8, the third annual Viterbi Lecture was presented by Jacob Ziv, distinguished professor of electrical engineering at the Technion Israel Institute of Technology. The Viterbi Lecture was created as the USC Viterbi School of Engineering's premier academic distinction in information technology and digital communications, an area of research in which the School is a national leader. Each year, an awardee who has made fundamental contributions of profound impact in communications will present the Viterbi Lecture.

Bing Gordon, Leonard Washington, Robert Pepper, Peter Bernstein, William Wulf, Dean Nikias and Seamus Blackley at the NAE Symposium at USC.

NATIONAL ACADEMY OF ENGINEERING MEETS AT USC

At a western regional meeting and academic symposium held March 22 at USC, the National Academy of Engineering (NAE) examined the "Intersection of Engineering and Entertainment."

USC President Steven B. Sample and NAE President William A. Wulf jointly opened the symposium after a luncheon and morning tour of USC's Institute for Creative Technologies in Marina Del Rey. Dean Nikias moderated a panel consisting of three other USC deans — Geoffrey Cowan, of the USC Annenberg School for Communication; Robert Cutietta, of the Thornton School of Music; and Elizabeth Daley, of the USC School of Cinema-Television.

Following the presentations by the four deans, a panel of speakers from industry looked at "Trends, Application, Entrepreneurship and Policy." Speakers included Seamus Blackley, creator of the Xbox, founder of the Capital Entertainment Group and current head of the video game division at Creative Artists Agency; Bing Gordon, co-founder and chief creative officer of Electronic Arts; Leonard Washington, founder/president of Paramount Digital Entertainment; Robert Pepper, chief of policy development at the Federal Communications Commission and Peter Bernstein, a composer.

Dean Nikias with his wife Niki, Dr. Hall and hosts Jean and Bruce Juell at their home.

SOUTH BAY EVENT

Jean (BA MUS '56) and Bruce (BSME '55, MBA '63) Juell hosted a reception at their home in Palos Verdes Estates on Wednesday, March 30. Dean Nikias along with over 40 alumni and friends attended a reception and lecture given by Senior Associate Dean and Director of the USC Homeland Security Center of Excellence Randolph Hall. Dr. Hall's presentation focused on "Robust Strategies for Terrorist Intervention".

Alumni news & notes

Winter and Spring 2005

1967

Michehl R. Gent (MSEE), president and chief executive officer of the North American Electric Reliability Council (NERC), announced his intention to retire at the end of 2005. He joined the company in 1980 as executive vice president and was elected president in 1982. Prior to joining NERC, he was general manager of the Florida Electric Power Coordinating Group. Before that, he held management positions at the Los Angeles Department of Water & Power. In addition to his USC degree, he earned a BSEE from Texas A&M. He also taught at the graduate schools of USC and Loyola.

1968

August F. Deluca (MSAE) has been named chief financial officer of Tag-It Pacific, Inc., a full service outsourced trim management department for manufacturers of fashion apparel.

1970

Norman F. Schneidewind (MSOR) will be assigned to a congressional office for the year 2005 on an IEEE Congressional Fellowship. He will be performing research on technical policy issues, writing speeches for congressmen, participating in hearings, interacting with constituents and acting as the science advisor to a subcommittee. particularly involved in homeland security issues.

1976

Bryan Groh (MSSM) has joined the international law firm of Bryan Cave L.L.P. as counsel in its St. Louis office. He concentrates his practice in civil litigation and represents clients in contract disputes, copyright infringement matters, employment disputes, medical malpractice suits, insurance disputes, medical malpractice claims, products liability suits and a range of other matters. He is also a former Air Force pilot and enjoys traveling and sailing.

1978

Adm. Craig E. Steidle (MSSM) has been named associate administrator of the Office of Exploration Systems. The office was established to set priorities and direct the identification, development and validation of exploration systems and related technologies. After retiring from the Navy in 2000, he served as an independent aerospace consultant.

1980

Roberto Medrano (BSEE) has been elected to the board of directors of Hispanic-Net. Hispanic-Net.org is a Silicon Valley-based, non-profit organization dedicated to strengthening networking opportunities for Hispanic executives and entrepreneurs in technology. He remains the executive vice president for sales and marketing at Digital Evolution. He has extensive senior management experience and is a recognized executive in the field of Internet security. He is an active member of President Bush's National Security Advisory Committee, National Cyber Security Summit and The White House National Strategy to Secure Cyberspace. He also holds a master's degree in electrical engineering from MIT.

1981

Rear Adm. Michael A. Sharp (MSSM) is vice commander of the Space and Naval Warfare Systems Command. He is responsible for development, acquisition, and life cycle management of command, control, communications, computers, intelligence, surveillance, and reconnaissance systems for the Navy, as well as select Marine Corps and joint service programs.

Tim Wood (MSSM) is the director of Oregon Parks and Recreation Department. In 1994, he retired as a colonel after 24 years of active duty in the U.S. Army, the final two years as commander of the Portland District of the U.S. Army Corps of Engineers. He lives in Lake Oswego, Ore., with his wife Sharon and sons Geoff and Cameron. As a volunteer, he coaches youth sports teams and is assistant scoutmaster for his sons' Boy Scouts troop.

1982

Timothy Traaen (MSSM) has been named senior vice president at Modtech Holdings, Inc., where he is responsible for continuous improvement and supply chain management. He previously held management positions at Solar Turbines. Before joining Solar, he was director of business development at Fleet & Industrial Supply Center. Prior to Fleet, he was business manager and financial controller aboard numerous U.S. Navy combatant ships and was director of business at the Naval Supply Systems Command Headquarters in Washington, D.C.

Vishal Wanchoo (MSEE) is president and chief executive officer of Healthcare Information Technologies, GE Healthcare. As the leader of this newly-created business, he and his team are developing a complete clinical information technology application that will enable a digital healthcare community, connecting patients, physician offices and hospitals.

1983

Richard Sulpizio (MSSM) is president for MediaFLO at QUALCOMM Incorporated, a leader of Code Division Multiple Access digital wireless technology. In this position, he will provide strategic direction and manage all of MediaFLO's operations. From 1998 to 2001, he served as president and chief operating officer of QUALCOMM.

1985

Barry Tilton (BSEE) will be retiring from the Air Force after 20 years this summer.

Carl Weisman (MSEE) is a senior engineer at 5G Wireless Solutions. He began his career at Hughes Aircraft Company as a design engineer, working on radar for fighter aircraft. During his time there, he was awarded the Hughes Fellowship, which enabled him to pursue his master's degree at USC. He also received an MBA from Loyola Marymount University and is the author of *The Essential Guide to RF* and *Wireless.*

1986

Orna Berry (Ph.D. CS) joined the board of directors of Commtouch, an innovator of real-time email security solutions. She is a venture partner in Gemini Israel Funds, having co-founded ORNET Data Communication Technologies Ltd., an early Gemini portfolio company, which was later sold to Siemens.

Irwin King (MSCS, Ph.D. CS '93) was recently appointed to coordinate the Engineering Undergraduate Student Exchange Program (EUSEP) at the Chinese University of Hong Kong. He will begin his duties next year and looks forward to pursuing collaborative opportunities with the School, both in terms of faculty and student exchanges and joint research projects.

1987

Bob DeFeo (MSCENG) has been appointed chief executive officer of Envivio, Inc., a leading technology provider of MPEG-4 systems. Prior to joining Envivio, he was the CEO of Teranex, where he contributed to its success as the leading provider of high-quality image processing solutions for the broadcast, post-production, and high-end home theater markets.

Rich Faris (MSEE) is the director of marketing at Real Intent, Inc., a leading supplier of formal assertion-based verification software for electronic design verification

1989

Nicholas Chong (BSEE) has been appointed managing director of Newtex Asia Pacific Pte Ltd. He previously served as general manager and executive director at the Singapore-based Pyrogard Technologies Pte Ltd., a fire alarm control panel manufacturer.

1995

Christopher Leddy (MSEE) has been programming computers for more than 30 years and specializes in embedded systems hardware and software. He is currently a senior principal systems engineer at Raytheon.

Nomer Oytas (BSAE), a navy lieutenant, recently reported for duty aboard the newest nuclear aircraft carrier in the U.S. Naval Fleet, the USS Ronald Reagan, homeported in San Diego. Nomer and his wife, **Maria Campana Oytas** (BSES '97) celebrated the birth of their second child, Nathaniel Ray on November 3, 2004.

2000

Nakarin Netcharussaeng (MSEE) joined Siam Preserved Foods four years ago. He is responsible for marketing and trade and has helped maintain existing markets in the United States, Europe and Australia, while developing new clients in Asia.

Staff and Faculty News

Isaac Cohen, assistant research professor of computer science, and his wife Jamie announce the birth of their twins, Estelle-Miriam and Marcel-Joseph, on November 9, 2004.

Shawna Jones recently joined the School as director of development operations. She previously served as executive assistant to the vice president for academic affairs and dean of faculty at Whittier College.

Cami Lee-Shono, a marketing assistant for Distance Education Network, and Akira Shono welcomed a baby girl to their family. Madeline Mei Yung Kimiko Shono was born on September 28, 2004 at 6:15 a.m. and weighed 5 lbs., 1 oz.

Kirstin Kohn Strickland has been named director of alumni relations for the Viterbi School of Engineering. She formerly held the position of associate director of corporate and foundation relations. Prior to the Viterbi School, Kirstin worked for the USC Alumni Association. Kirstin comes from a background in marketing and business development in the technology industry.

Jackie Williams, a marketing manager for Distance Education Network, and her spouse Jeff, announce the birth of their son Duke Warren Williams. Duke was born on March 16, 2005 at 5:24 a.m., weighing 6 lbs., 10.5 oz.

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

New Board of Councilors Member

Feng Deng (MSCS '93) was co-founder, vice president, chief strategy officer, and member of the board at NetScreen Technologies. He and a partner, Yan Ke, founded NetScreen in 1997 with the help of Silicon Valley venture capital giant, Sequoia Capital.

At NetScreen, Deng focused on corporate strategy, ensuring that it attained its goal of becoming the world's leading network security company. Deng successfully led NetScreen's research and development activities, helping to build its industry-leading network security products. In April 2004, Juniper Networks acquired NetScreen for roughly $4 billion in stock, and Deng was subsequently appointed chief strategy officer at Juniper Networks.

Deng received his undergraduate degree from Tsinghua University in Beijing, China. In 1986, when he was a 22-year-old senior, he read a translation of *The Fire in the Valley* about the early digital entrepreneurs and the origins of the personal computer.

"It was all about Silicon Valley, and from then on I wanted to build my own business," he said. Deng worked in China after graduating from Tsinghua, then came to USC on a scholarship in 1990.

He received a master's of science degree in computer engineering from the Viterbi School in 1993, then began work on his Ph.D. but was lured away by Intel. He held several technical positions there, including working on the design and development of generations of microprocessor and chip-set products.

An active alumnus, Deng is interested in fostering a relationship between the Viterbi School and Tshinghua University *(see story on the Viterbi School's China Strategy on page 19)*. He is also considering the Distance Education Network as a product that Juniper Networks might want to research for its employees.

In Memoriam

Robert L. Richardson (BSPE '48) of Ventura, Calif., passed away on February 2, 2005 at the age of 79 due to heart failure. Robert spent 49 years as a consultant to the burgeoning oil industry in California. He was responsible for the drilling of over 100 oil wells on three continents and was credited with the discovery of oil in the "Richardson area" of the Eureka Canyon Oil Field. He was certified as both a registered professional petroleum engineer and geologist by the state of California, and held a U.S. patent, "Magnetic Wire Line Marking, Erasing and Detection Method and Apparatus." Robert is survived by his wife Betsy, daughter Susan Putman, son Steve, and four grandchildren, Cory and Neil Putman, and Susha and Nattie Richardson.

Glenn Emery Ronk (BSME '50) passed away on January 15, 2005 at the age of 79. Glenn was a veteran of World War II and a long-time senior executive in the electronics industry, having retired as an executive vice president of General Signal in Stamford, Conn. He is survived by his wife Barbara Lee and his four children Connie, Edward, Martin, and William.

Alumni Recognition

The Orange County Engineering Council honored Civil Engineering Professor **Dr. George Chilingar** (BSPE '49, MSPE '50, Ph.D. GEOL '56) at their annual awards banquet with the Distinguished Engineering Educator Award. The OCEC Recognition Program is designed to honor engineers and their projects for their engineering excellence.

Major selection criteria include: engineering and technical expertise, innovative design ability, generous support of engineering education and outstanding professional service to the Orange County community. The OCEC's mission is to "enhance the public image of engineers and scientists and promote the interaction of the professional societies and engineering/scientific corporations in Orange County, California."

In more than a half-century of academic achievement, George Chilingar has published 53 books and hundreds of articles in the fields of geology, petroleum engineering and environmental engineering. His greatest contribution to the petroleum industry is a means of identifying oil-rich rock by analyzing the ratio of Calcium/Magnesium in core samples. He has also donated $101,000 to the Viterbi School, creating the George V. Chilingar Scholarship Endowment in Civil Engineering.

The School congratulates him on this latest achievement.

Entrepreneur Helps Launch Other Careers

It is well known that in addition to educating generations of engineers, USC's Viterbi School of Engineering is a launching pad for talented individuals in all fields of endeavor. Philip R. MacDonald (BSCE '70, MBA '72), a genially unassuming entrepreneur, has parlayed many of the skills he developed at the School into a successful business career.

MacDonald followed the academic lead of his father, Scott MacDonald (BSCE '37), by deciding to study engineering as an undergraduate at USC. "But once I had earned my degree," MacDonald says, "I knew I really wanted to go into business for myself, so I decided to get an MBA."

Upon leaving USC, MacDonald worked in the world of high-rise development. Once again, he benefited from his academic training. "Solving problems is what engineering is all about," he says. "Engineers have an indomitable spirit. They're always trying to fix things or create something new and better. Thanks in large part to my engineering studies, I was very quick to pick up the latest technologies and adapt them for the construction field. This differentiated me from other contractors, and helped me to get ahead."

Today, MacDonald's specialty is restaurant franchises. His holding company owns 21 Baja Fresh franchises and three Panera Bread franchises. His family also owns the oldest remaining Bob's Big Boy restaurant in America. Located in Burbank's Media District, this restaurant was designed by noted architect Wayne McAllister and built in 1949 by MacDonald's father.

After acquiring the restaurant from Marriott in 1993, MacDonald began restoring its past glory as a prime example of the California coffee shop style that took the country by storm in the 1950s. MacDonald also rehabilitated the monumental freestanding, 70-foot high "Bob's Big Boy" sign that soars vertically over the restaurant, along with a fully intact cantilevered, boomerang-shaped steel awning that covers what was originally drive-in parking. The State of California has honored the restaurant by naming it a State Point of Historical Interest, and it is included in numerous tourist guides and travel websites.

Having built his own business empire, MacDonald has now decided to expand his horizons through philanthropy. He has pledged a total of $250,000 to fund an Endowed Early Career Chair, to help bring exceptional young faculty members to the Viterbi School of Engineering, where they will launch their own stellar careers.

The funds generated by the endowment will provide the chair-holder with relocation expenses, research funding and stipends for traveling to academic conferences. "I believe that this endowed chair will be a great enticement for recruiting the best and brightest young scholars in the world to USC," says MacDonald.

Dean C. L. Max Nikias agrees: "Phil MacDonald's pledge is vitally important to the School of Engineering because endowed chairs are one of our most powerful means of attracting and retaining top-quality faculty," he says. "We are extremely grateful that Phil has chosen to play a leadership role in helping the School compete successfully in this vitally important arena. It is my hope and expectation that Phil's generosity will have the value-added effect of encouraging others to support the School's efforts to build a faculty of preeminent scholars in each of our engineering disciplines."

MacDonald's decision to endow a faculty chair builds upon his many years as a dedicated advocate and volunteer for the School. He is a member of the Engineering Associates support group, and he has helped to organize several of his class reunions. "My closest friends today are from Kappa Alpha fraternity," he says, "and I encourage them to give generously to their reunion class gift."

MacDonald's loyalty to the School and USC grew out of a solid family tradition. "Sixteen MacDonalds have graduated from USC," he explains, "including my father, five uncles, numerous cousins and three children. When I was a kid, I rarely missed a chance to accompany my Dad to watch the Trojans battle at the Coliseum."

MacDonald became a Trojan athlete in his own right as an undergraduate student, playing centerfield for the baseball team. "I was on the team during my freshman and sophomore years," he says. "We won the national championship in 1968. But after that, it became too tough academically, so I focused on my studies instead." Nonetheless, he notes with modest pride, "My name is on a plaque at Dedeaux Field," although he adds with good-humored chagrin, "but it's misspelled as 'McDonald!'"

The MacDonald clan's impressive "Trojan Family" legacy accelerated when Phil met his future wife. "I met Cayley (MAPT '75) during a road trip to UCSB," he explains. "We hit it off, and I convinced her to come to USC for her master's degree." Today, three of the couple's four children also hold degrees from USC: Rory (BS BUAD '00), Reid (BS MUIN '03) and Darcy (BA COMM '03).

The MacDonalds have lived in Orange County since 1976. They are avid Trojan sports fans who always drive north to attend USC football games and frequently attend baseball and basketball games as well.

C. L. Max Nikias Named USC Provost

C. L. Max Nikias, professor of electrical engineering and dean of the USC Viterbi School of Engineering, has been named provost and senior vice president for academic affairs at the University of Southern California. He will begin his new duties June 1, 2005.

The provost is USC's chief academic officer and the second-ranking officer under the president. All of the university's deans report to the provost, as do the divisions of Student Affairs, Information Services and Enrollment Services. He serves with the senior vice president for administration as the chief operating officer of the university.

"No single appointment is more important to the success of this university than that of the provost," says USC President Steven B. Sample. "For that reason, we went to extraordinary lengths to make sure we had access to the very best candidates. All told, more than 160 people applied for or were nominated for this position. In the final analysis, Max Nikias had the combination of abilities and experience that I believe will best serve this complex research university at this critical juncture in its history.

"This is a man who is internationally recognized for his research on integrated media systems, digital communications and signal processing, and biomedicine, and who is also a passionate advocate of the arts and humanities. In the 14 years he has been at USC, he has worked assiduously with faculty from the USC College and most of the professional schools in promoting interdisciplinary research and education. As dean, he has built the Viterbi School into a research powerhouse, and at the same time has focused on the education of undergraduate and graduate students and post-docs. He has been instrumental in bringing major research institutes to USC that continue to benefit the entire university.

"Max is a visionary with his feet firmly on the ground. He is an effective fundraiser who is able to inspire private donors, foundations and government agencies to invest in USC. He has deep respect for USC faculty and will work closely with the deans to get them the support they need to operate at the highest levels," says President Sample.

Nikias replaces Lloyd Armstrong, Jr., who is returning to the faculty after serving as USC's provost for the past 12 years.

"President Sample has been an extraordinary leader for USC. I'm deeply honored, and also very excited, for this opportunity to truly make a difference by being part of Steve's senior leadership team," says Nikias. "USC's rise in national reputation has been one of the fastest, if not the fastest, of any university in the nation. This is the moment in USC's history where we have a big responsibility to ensure that the ascent continues by accelerating our trajectory."

Nikias credits Provost Lloyd Armstrong not only for leading the academic strategic planning process throughout his 12 years as provost, but also for his success in getting the buy-in of deans and faculty to these plans. "Lloyd was a great mentor to me during my time as dean of the Viterbi School and was also available to consult with me on difficult issues. I will continue to seek his advice as I take on my new responsibilities.

Calling the USC College of Letters, Arts and Sciences "the beating heart of the university," Nikias says that "Dean Joseph Aoun has the College on its own very rapid ascent. The College will continue to be a top priority."

Nikias has been on the USC faculty since 1991 and has served as dean of USC's Viterbi School since July 2001. He leads a school that is consistently ranked among the top 10 engineering schools in the United States. He has spearheaded dramatic increases in the quality of students, in research growth, in fundraising for the School's endowment and in the expansion of distance education programs.

Nikias was the founding director of two national research centers at USC: the National Science Foundation (NSF) Engineering Research Center (ERC) on Integrated Media Systems and the Department of Defense Center on Communications Signal Processing.

Nikias has been instrumental in supporting the Information Sciences Institute in the Viterbi School, and in working with faculty across the university to establish the two NSF ERCs as well as the Department of Homeland Security's first Research Center of Excellence.

Nikias is the author of more than 100 peer-reviewed journal articles, 180 refereed conference papers, three textbooks and eight patents. Several of his publications and patents are in the field of translational medicine, including invasive and non-invasive methods for the detection and classification of myocardial ischemia, which he did in collaboration with the University of Maryland Hospital and Buffalo General Hospital. He has mentored more than 30 Ph.D. and postdoctoral students. He has consulted extensively for the U.S. government and high-tech industry during the past 20 years. He also has testified extensively before the California legislature on the impact of digital technologies and communications on the entertainment industry and on the California economy.

Photo by Max S. Gerber

Nikias has received numerous research and teaching awards and honors, including three Best Paper awards. He was recognized as an outstanding teacher by the National Technology University, a consortium of top research universities engaged in distance education. Nikias is a Fellow of the Institute of Electrical and Electronics Engineers, Fellow of the California Council on Science and Technology, and received a formal commendation from the California Governor for cutting-edge research. He is a member of Phi Kappa Phi.

Nikias serves as a member of the Board of Directors for the Lord Foundation of California and the Alfred Mann Institute for Biomedical Engineering at USC, and as a member of the Board of Trustees of the Chadwick School, an independent school in Palos Verdes Peninsula, Calif.

A native of Cyprus, Nikias is an honors graduate of the Famagusta Gymnasium, a school that emphasized history and Greco-Roman classics. He is a recipient of a diploma from the National Polytechnic of Athens. For his graduate studies, he attended the State University of New York at Buffalo, earning master of science and a doctor of philosophy degrees. He is a recipient of an honorary doctorate from the University of Cyprus.

Nikias lives in Rancho Palos Verdes with his wife, Niki, and their daughter Maria. Their daughter Georgiana is a student at the USC College.

"My wife Niki, our daughters, and I feel we are rooted to this university," says Nikias.

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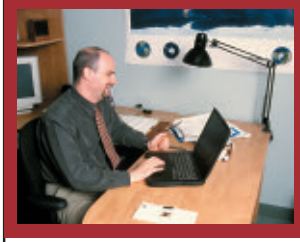



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