enVision
MAGAZINE

The Future of Healing

By Janet Dawald

A very relieved Steve Saddow watched the family holidays from his bed. The teenager was recovering from a painful operation where bone cells from his hip had been harvested to fill the cavity where a bone tumor had been in his leg. His life had changed overnight. A carefree kid who loved baseball and backpacking, biking and science, was told that he was lucky. Had it gone unnoticed, he could have lost his leg. After weeks in bed, he slowly progressed to a wheelchair, then a walker, and finally a cane. This harsh lesson in discomfort and immobility was not forgotten, but the dreams of the big leagues were.

"I had taken high school biology," laughs Saddow, electrical engineering professor, "and I told my doctor to grow some bone cells in a Petri dish, don't chisel them from my hip!" At that time, the technology to grow bone cells on an artificial scaffolding was decades in the future. Saddow went on to earn his PhD from the University of Maryland at College Park in electrical engineering (electrophysics). For ten years he specialized in silicon carbide semiconductor technology and high-power electronics. In the meantime, he was working on a Navy project with Carnegie Mellon University and the University of Pittsburgh and learned that they had been working on growing bone cells on porous silicon carbide. "When I heard that bone cells grow like crazy on porous silicon carbide, wow," he remembers. "It was personal, it really got my attention."

Silicon carbide (SiC) is a compound of silicon and carbon. Rare on planet Earth, it is found only in kimberlite, the same volcanic rock that produces diamonds. In space, silicon carbide is a common form of stardust. It is also found in certain meteorites, indicating an origin far beyond our solar system. Most silicon carbide is synthetic,

L. to R.: Jennifer Voegler, Christopher Frewin, Edwin Weeber, Luis Mariusso, Joseph Register, Justin King and Luca Abbati.

and is costly to manufacture. Carborundum, a granular form of silicon carbide, is used as an abrasive. Over 250 crystalline forms of silicon carbide have been created in the laboratory. One of them, moissanite, is a gemstone that rivals the brilliance of a diamond.

In 1907, the compound emitted a blue electroluminescence, long before anyone thought of light-emitting diodes. Saddow's research on this remarkable compound has ranged from its use as a semiconductor to its amazing electrical, optical, mechanical, chemical and now, biological properties.

Investigation into the biocompatibility of silicon carbide became the focus of Saddow's work in 2005. Camilla Coletti, PhD, now at the Italian Institute of Technology in Pisa, pioneered research into the biocompatibility of silicon carbide. Her dissertation involved

L. to R.: Maysam Nezafati, Chris Locke, Shamima Afroz, Erich Radauscher and Stephen Saddow.

many *in vitro* studies which concluded that various forms of silicon carbide were tolerated by skin and other tissues. The next step was to determine if silicon carbide was compatible with blood. Norelli Schettini, now a professor at Universidad del Norte in Barranquilla, Colombia, worked with a specific crystalline form (3C-SiC). Her studies showed that blood platelets that adhered to the surface of the material did not start the clotting cascade while silicon, the traditional semiconductor used in biosensors, clearly did.

"This was amazing," recalls Saddow. "All the literature up to this point was inconclusive. Silicon and the hexagonal forms of silicon carbide performed poorly with platelets." He continued to explore specific crystalline structures of silicon carbide, including making his own right in the Engineering Building II on the USF campus. "We were looking at making sensors with our silicon carbide films," he explains. "We could work in proximity with blood, creating drug delivery systems. In ceramic form, we could make very small and smooth probes, eliminating the trauma that conventional probes had." Then a doctoral student, Chris Frewin, approached Saddow about using silicon carbide to record and stimulate neural signals from the brain. Frewin knew that the SiC group had demonstrated both the biocompatible and hemocompatible issues, but Frewin wanted to go further. He showed that *in vitro*, neural cells also grow on the group's crystalline version of silicon carbide. Now a post-doctoral researcher in Dr. Edwin Weeber's group at the USF College of Medicine, Frewin is exploring the use of silicon carbide in conjunction with optogenetics, along with one of Saddow's PhD students, Joseph Register, and one of Weeber's PhD students, Whitney Hethorn. This new field uses light to stimulate nerves and is looking to replace deep brain stimulation for neural disorders such as Parkinson's disease. "This is amazing," says Saddow, "You can stimulate a neuron with blue light, and turn it off with yellow, like a light switch.

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Unfortunately, the telecom glass optics when used in the brain are not biocompatible, and eventually kills brain tissue. Silicon carbide can be used as the vehicle for light." The non-magnetic properties of small silicon carbide implants in the brain also have an additional benefit when used with magnetic resonance imaging (MRI). "You can use cubic silicon carbide while monitoring functional brain activity," he explains. Current technology involves the rather Frankensteinian process of putting metal probes in and out of the brain while trying to capture brain activity with MRI.

Saddow brought on two more students to research how silicon carbide can monitor important blood functions. Shamima Afroz, a joint PhD student with Asst. Professor Sylvia Thomas (EE Department), is not only working on silicon carbide's glucose sensing abilities, but she is also investigating how silicon carbide can be used as a radio frequency (RF) antenna to transmit information about a patient's blood-sugar levels. Alexandra Oliveros, a PhD student and recipient of the USF Presidential PhD Fellowship, is working on detecting the precursors for a myocardial infarction. This is all possible because silicon carbide is not only compatible with tissue and blood, but thanks to its semi-conductive properties, it's also "smart."

"I had dozens of X-rays when I was healing from my bone operation," recalls Saddow with a twinge of concern. "What if you could make smart implants with silicon carbide that would inform the doctor that the bone graft using porous silicon carbide, was 60 percent healed, and then 80 percent healed?" Tiny antennas could transmit information about the healing process. Silicon carbide delivery systems could not only administer drugs, but transmit their results by monitoring specific blood markers. And if brain cells could be "trained" with light, could silicon carbide also be used as an interface between a machine and human tissue?

The answer is yes. The Defense Advanced Projects Research Agency (DARPA) has awarded Saddow's group (and Weeber, College of Medicine, as Co-PI) with a $1.2 million research grant to explore the biocompatibility of candidate neural implant materials. The Biocompatibility of Advanced Materials for Brain Machine Interfaces (BAMBI) project is the latest in funding for Saddow's silicon carbide group. The interdisciplinary group's extensive expertise in biocompatibility will be leveraged to explore and expedite new and promising materials. Saddow points out that prior USF seed funding was critical to the success of the DARPA initiative.

The USF Center of Excellence for Biomolecular Identification and Targeted Therapeutics (BITT) provided funding for the 3C-SiC *in vivo* studies by Frewin. A USF College of Engineering interdisciplinary research grant, which was matched by the College of Medicine, along with a Neuroscience Collaborative grant from President Genshaft and other smaller grants were instrumental in getting the research funded and recognized.

Saddow just completed his first summer at the University of San Paolo in San Carlos, Brazil with the Scientists Without Borders project. His commitment to expanding knowledge and research across institutions worldwide is evident. His new book, Silicon Carbide Biotechnology**,** explores the biomedical applications of silicon carbide. "There are many things that silicon carbide can do for millions of diabetics," he muses. "Brain machine interfaces are sexy right now, but just think what we can do for glucose monitoring or preventing heart attacks. That is where we will make the biggest contribution."

Message From The Dean

Dean John Wiencek

College of Engineering Welcomes Lakeland Technology Program

Florida Senate Bill 1994 was signed into law by Governor Rick Scott in April 2012. This bill effectively shut down USF Polytechnic in Lakeland, and took effect on July 1, 2012. However, the students attending this school will have until 2016 to complete their degrees at the Lakeland campus. The school, formerly known as USF Polytechnic, is now technically a part of the Tampa campus.

All of the programs, including business, arts and sciences, and engineering have been continued there and are also in the process of being offered on the Tampa campus. The Tampa campus will be the beneficiary of all of the programs of the Lakeland school; none of the other USF campuses are involved.

How is this happening? An accredited university, such as USF, cannot shut down its doors like a business. The process that enables students to complete their education at a given institution is called a "teach-out." Defined as a written agreement between accredited institutions, it provides for an equitable treatment of students if one of those institutions stops offering educational programs. The institution continues to teach currently enrolled students, but no longer admits new students to its program, and ceases to operate after the students have graduated. Here in Florida, this means that students have the choice to complete their education (under the auspices of USF Tampa) in Lakeland until 2016, or physically transfer to the Tampa campus if they prefer. In effect, USF Tampa in Lakeland is an instructional site, similar to a classroom in Tampa, except located in Lakeland. There are certain restrictions, such as if a student withdraws or fails a course in the teach-out in Lakeland, he or she may be required to re-take the course at the Tampa campus. There are currently 127 undergraduate students and 23 graduate students enrolled at the Lakeland campus in the Information Technology program. These students will have a

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Editor	Janet Gillis MS Bus '00
Writers	Janet Dawald Tom Edrington Janet Gillis Desa Philadelphia David Ramos Marcus Rodriguez
Photography	College of Engineering Chen Wang Roger Cox, PE, '85
Designed by	Ryan Wakefield

MISSION STATEMENT

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To be added to our mailing list or for more information, contact:

Janet Gillis
Communications and Marketing Officer
College of Engineering
University of South Florida
4202 E. Fowler Ave. ENB 118
Tampa, FL 33620
email: *janetgillis@usf.edu*

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USF UNIVERSITY OF SOUTH FLORIDA COLLEGE OF ENGINEERING

Civil Engineering Professor Rajan Sen Named Jefferson Science Fellow

Professor Sen will serve as USF's first Jefferson Science Fellow during the academic year 2012-13 at the U.S. State Department

By Janet Gillis

Rajan Sen, PhD, PE professor of structural engineering, has been named University of South Florida's first Jefferson Science Fellow. He is one of 12 Jefferson Science Fellows for 2012-2013 named by the U.S. State Department. Sen, has held appointments in the College of Engineering and the School of Architecture and Community Design as well as the inaugural Samuel and Julia Flom Endowed Chair, is the first professor at the University of South Florida to be appointed a Jefferson Science Fellow.

As JSF, Sen will advise the U.S. State Department on engineering issues as they relate to international diplomacy and policy. He will serve in the State Department for one year, beginning August 13 and will return to USF after the appointment ends, but remain available to the U.S. Department of State to serve as a field expert for the following five years.

Established in 2003 after 9/11 and the anthrax attacks, the JSF program provides a vital link between policymaking social scientists in the U.S. Department of State and senior scientists and engineers from prestigious universities across the United States. The program helps bridge the worlds of science, technology and policymaking by providing a greater understanding and awareness of scientific knowledge to State Department officials on a wide array of issues such as biosecurity, climate change, food security, geography, space sciences and genetic evolution, according to a 2010 Carnegie Corporation report.

"My interests lie in the areas of disaster mitigation and low-cost housing," said Sen. "But, I will not know where I serve until I arrive in Washington, D.C. I will interview with different bureaus within the State Department and those interactions will determine where I am assigned."

After graduating first in his civil engineering class from the prestigious Indian Institute of Technology, Kharagpur, Sen completed a master's degree in structural engineering from the University of British Columbia. He spent a decade at the Department of Transport in London, working closely on the development of bridge design software and the first load and resistance factor bridge design code, BS 5400. Following its publication, he left to pursue his doctorate in civil engineering at the State University of New York Buffalo. Publications from his dissertation on boundary elements are still in citation 25 years later.

Under his leadership USF was among the first universities in the world to explore the use of fiber reinforced polymers (FRP) for the repair and rehabilitation of civil infrastructure. He has made pioneering contributions on FRP durability, its application for strengthening steel and underwater pile repair. His research led to the construction of Florida's first post-tensioned voided slab bridge in Miami and his work has been featured in *Steel Bridge News and Composites Technology*. His research has been funded by Florida Dept. of Transportation, National Science Foundation, Transportation Research Board and the U.S. Army Corps of Engineers.

The Dean of the USF College of Engineering, John Wiencek, supported Professor Sen's nomination and was very pleased to hear of his selection. "Dr. Sen is well respected by students and faculty alike. He has a very sharp wit and is able to effectively analyze and communicate very sophisticated concepts. His ability to motivate and communicate was clearly demonstrated over the past few years as he mentored our students in the Big Beam contest of the Precast/Pre-stressed Concrete Institute where the USF students have consistently placed very high in the state and national competitions. Working in the civil engineering field, Dr. Sen is acutely aware of the policy aspects of engineering solutions and the importance of communicating with the public. I am confident that his tenure as a Jefferson Science Fellow will provide great value to our government and to our global partners."

Sen has edited two books and authored over 200 publications including more than 80 journal papers. He has made more than 140 presentations worldwide and was a NSF sponsored US delegate to conferences in Europe, Japan and India and an invited speaker for the US Southern Command. He is a Fellow of the American Concrete Institute and the American Society of Civil Engineers, serves on FRP committees in Europe and US and is on the International Advisory Board of India's Fiber Reinforced Polymer Institute. He has chaired international conferences, and is the recipient of awards from USF, the Pre-stressed Concrete Institute and the American Institute of Architects for his contributions to teaching, research and service.

> "You get an international perspective of the complexities of the world through this unique experience," said Sen, "and I am committed to bringing this knowledge to students here at USF."
>
> - Professor Rajan Sen

The Jefferson Science Fellows Program is funded by the U.S. State Department with additional support from participating universities. The program is endorsed by numerous professional scientific societies and organizations, including the National Academy of Sciences, which administers the program.

Each fellow receives a $50,000 stipend from the State Department for living expenses for a full year. An additional $10,000 is available to each fellow through the National Academies for travel associated with his/her assignment. Fellows also continue to receive salaries and benefits from their home institutions.

All Jefferson Fellowships are contingent upon awardees obtaining an official U.S. government security clearance.

To learn more about the Jefferson Science Fellows Program, visit http://sites.nationalacademies.org/PGA/Jefferson/index.htm.

Prof. Rajan Sen

Professor Ranganathan's Formula for Graduate Student Success

By Tom Edrington

The year was 1988 and the College of Engineering at the University of South Florida was relatively small, relatively unknown back then. Electrical Engineering was the king of the hill and the Computer Science & Engineering department was an infant. Nagarajan Ranganathan had just earned his PhD.

Fast forward to 2012 and computers are king. They drive our world and the College of Engineering is doing its part to take the wheel. Enter the office of Professor Ranganathan and you'll find him smiling, inviting you in and greeting you with a handshake and the request: "Call me Ranga!"

It would be easier to name the awards he hasn't received during his tenure at USF. The one that best characterizes him these days is the Distinguished University Professor Award bestowed on him in 2007 along with the University Gold Medallion. He holds eight U.S. patents, has edited four books and authored or co-authored enough publications to fill the Sunday editions of the Tampa Tribune and Tampa Bay Times, combined.

His expertise is VLSI (Very Large Scale Integration) circuit and system design. He was one of the pioneers in hardware data compression, starting in the '80s when the technology was still relatively new.

These days his research is cutting edge and he focuses on the talented graduate students that he mentors. His list of students shows a long line of achievement in both the academic and corporate worlds. If he was a college football coach, he would have scores of All-America players on his resume. His students have gone on to distinguish themselves with major technology companies others have made their mark within the academic world.

"The key measure for success is how they (his students) perform after they leave here."

- Professor Nagarajan Ranganathan

One who set a very high bar, who has distinguished himself, is Professor Vijay Narayanan. You can find him at Penn State University where he is the co-director of the Microsystems Design Lab where he oversees 50 graduate students. Narayanan was given the Outstanding Research Award by the school's Engineering Society in 2006 and he's garnering more. He's also doing what Ranganathan taught him, he is making a difference.

"For five years, he was my right and left hand here," Ranganathan recalled. Narayanan received his PhD in 1998. Narayanan, likewise, has a fond and grateful place in his heart for his time with Ranganathan.

"Professor Ranganathan is a great mentor," he said when asked about the man who guided him at USF. "He provided the best platform for my academic career. He worked tirelessly on shaping my technical presentation and interpersonal skills as a student. Not just me, every student that he has supervised. I am grateful to have had the opportunity to be his student," powerful words from a student who is distinguishing himself in the Penn State academic community.

Another one of Ranganathan's memorable students is Ransford Hyman, Jr., who received his PhD in 2011 and is now Validation Solutions Developer for Intel Corporation in California. Hyman was brought to USF by Bernard Batson, the College of Engineering's Associate Director Student Services.

"Bernard identifies and recruits African American and Hispanic students with academic potential," Ranganathan explained. "Ransford came to us with a BS in math. He didn't know much about computer engineering but he came here and wanted to pursue it. He was a very hard worker and very bright. Halfway through (his graduate work) he lost his father. That day was very, very significant," Ranganathan recalled.

At that moment, he became more than a professor. He was a best friend and perhaps, if not a father-figure, a "fatherly" figure. He helped Hyman through his great loss and kept him moving toward his PhD.

"Today he is in a good place," Ranganathan said with a big smile. "We stay in touch." That's the case more often than not with most of his students. "I stay in touch with them. While they were here, I'd walk with them through everything. It builds great bonds in life."

Raganathan's doctoral graduates aren't the only ones drinking from the fountain of professional success. Plenty of master's recipients have gone on to great places in different geographic regions.

Kiran Doreswamy (MSCS '95) went from the NEC Research Labs at Princeton to Intel Corp. in Oregon. Srinivas Aruru (MSCS '96) went to Intel then became a principal engineer at Broadcom in San Francisco.

Shankar Arumugavelu (MSCS '07) is a Senior Vice President and Chief Information Officer at Verizon Telecom in New York. Jeff Fleider (MSCP '92) is at Ford Microelectronics in Denver.

Some have been bitten by the entrepreneurial bug and now own their own companies.

Naveen Bhavanishankar (MSEE '97) is the founder and managing partner of NCI in Portland, Oregon. Before he started the company, he was a product manager with Intel.

Ryan Mabry (MSCP '07) took his skills to the world of law enforcement and works for the FBI in Pensacola.

The list goes on. You will find successful software engineers, database administrators, project managers, and much more. Many of Raganathan's success stories have become company executives. Success is the common denominator in the entire process of producing these individuals who have studied under his watch.

"I'm hands on" is how Ranganathan describes his style. "We need that. It gives me satisfaction. I walk with them (his students) through everything. It is important that they build credentials when they are here with me. I will make them co-chairs or co-publishers on papers and journals. It helps their future and their credibility. The key measure for the success of our programs here at USF is how they do after they leave here.

"By the time they graduate and receive those degrees," Ranganathan continued, "they are very independent researchers. Also, it is important that I help them identify what future path they want to walk professionally and make sure they move in the right direction and work in the areas that will help them achieve their future goals."

With an eye on the futures of his students, Ranganathan continues on his daily path. In addition to his teaching responsibilities, he serves as faculty liason to the USF Board of Trustees.

He balances his busy professional days with quality time at home with his wife Radhika, a medical doctor who is a pediatrician in Wesley Chapel. "I am blessed to have a wonderful wife and two amazing children," he said, showing his trademark smile. He enjoys his time at home. "I still love to sit down and read the morning newspaper," he said. "And I love football. I love our USF Bulls and our Buccaneers!"

"Ranga" is a man who loves his family, his school and his profession. It shows in his accomplishments and it shows in the students he has sent into the world. He is a man of influence and it is one of his scholarly observations that sums up the path he sets for all of his students and the education he provides them.

"It's not where you are," he concluded. "It's what you do that matters."

Sometimes the Greatest Innovations in Life Come When Least Expected

By Tom Edrington

Assistant Professor Yu Sun was observing University of South Florida surgeons Alexander Rosemurgy and Sharona Ross performing a natural orifice transluminal endoscopic surgery at Tampa General Hospital. He was there with a group of medical students observing a minimally invasive procedure.

Minimally invasive surgery is a big thing these days. Any surgery, by nature, is invasive but less is best from a patient's standpoint. While Sun observed the procedure, the light bulb of innovation sparked and brought him a mental vision and he thought to himself:

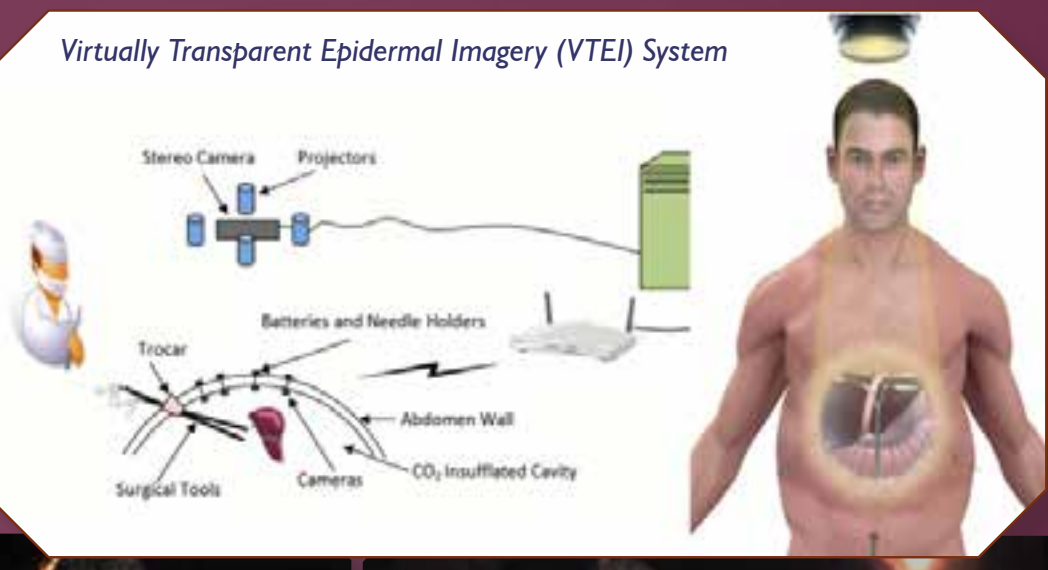
"What if the surgeons could see an accurate picture of a patient's internal organs as an image there on the patient's abdomen, a picture that displayed the internal organs as though the doctors had the equivalent of X-ray vision?" He looked at the patient's blank abdomen and thought that it would make a great display screen if the right technology could be developed.

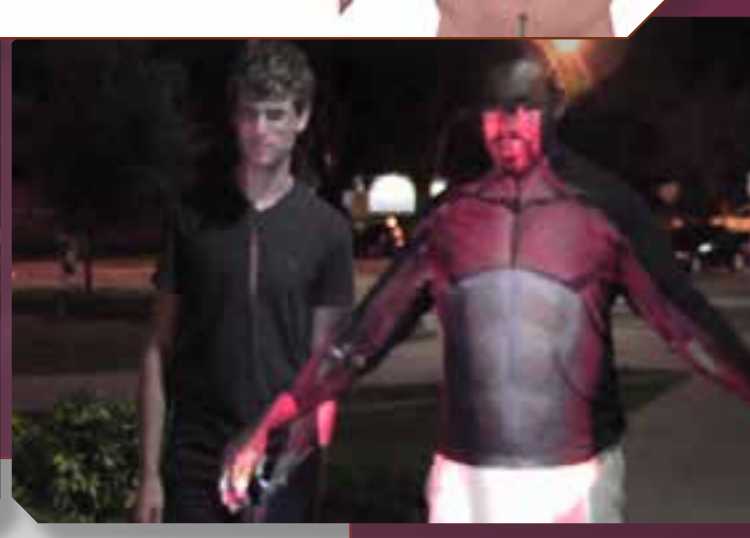
Think, for a moment, how something like that would revolutionize surgical procedures. Think of the possibilities, think about what that would mean for modem medicine.

Sun has gone past the thinking stage and he is doing something to make it all come to reality. He is well on his way to producing a new technology that falls under the name Virtually Transparent Epidermal Imagery. It's part of the amazing work that goes on daily at the College of Engineering's Robotic Perception and Action Lab (RPAL).

Sun's efforts are supported by a grant from the National Science Foundation: "Virtually Transparent Epidermal Imagery." Actually, it is a technology that will reduce accident rates and make the world of minimally invasive surgery an easier place for doctors to navigate.

Virtually Transparent Epidermal Imagery (VTEI) System





Spacial Augmented Reality for Education

That word "navigate" is a key ingredient to Sun's work with this exciting technology. "When physicians perform laparoscopic procedures, they are holding their surgical instruments and simultaneously looking at monitor," Sun observed. "It takes time and training to be able to sense the locations of instruments relative to the internal surgical area.

It is also important that the physician have a good view of the entire area as well. Sun has come up with a micro-camera network that is composed of multiple cameras, as Sun describes it. "It would generate a panoramic view from the network of cameras; the surgeon could see any area within the patient's main cavity in high resolution."

That high-resolution display on the patient's skin would be the result of a 3-D projector that brings the image to life. The result would give an appearance of transparency on the patient's skin and single-incision surgery takes on all the benefits of open cavity procedures.

Basically, in the most simplistic terms, this invention would bring the inside of the patient to the outside and provide the correct hand-eye coordination that is so essential to the minimally invasive procedures practiced today.

Sun's dynamic ideas have him working closely with the physicians at USF. He gets to combine his engineering expertise with their medical knowledge. "I get to be with some great resident doctors in their research labs," he pointed out. "It's a team effort and they are wonderful partners in this venture."

The venture is a complicated one in that it involves a future medical device. It has to undergo extreme testing and it's a long way from FDA approval. There is no doubt Sun will have it ready in good time. He has an incredible background in robotics, haptics and computer vision and spent 2007 to 2008 at the Mitsubishi Electric Research Labs in Cambridge, Mass, before coming to USF.

The camera itself has a very futuristic look to it. The camera can be produced at a fairly manageable cost, about $100 to $200. It is rechargeable and the software that makes it function would bring the total number for the entire system to around $10,000, which is small change in the world of medical costs.

The need for this technology is immediate but Sun concedes it's going to take a while. "If everything goes well, probably 2017," he predicted. "This started out as a three-year grant but we will have a two-year extension to work on it, so that should be fine. So far, the process is working."

Sun had a chance to show off his work at the 2012 Engineering Expo where students from grades K-12 are introduced to the worlds of science and engineering. A projection of a body's internal organs was made on some of the visitors and it was a huge hit, as RPAL was picked as the best lab in the Expo. "It was an honor to be picked as the best of the labs," Sun said.

The On-body Immersive Learning System, an offshoot of the surgical research project, captured the attention of the hundreds who experienced it first-hand. Sun is enthusiastic about the future of his project and knows it's only a matter of time until it becomes a reality in the world of surgical medicine.

Change for the better in this surgical technique is on its way. A few years from now, surgeries will take less time, they will be even less invasive and it will be easier for physicians to learn the skills necessary for successful procedures.

Those doctors may not know it yet, but one day they will have the equivalent of X-ray vision.

choice to continue for the next four years (the teach-out time) at the Lakeland campus, or transfer to the Tampa campus.

For four years, courses in the various degree programs will be offered at both locations, but obviously will be phased out over the next four years in Lakeland. "For the most part," explains Dean John Wiencek, "our programs were either identical or very comparable to the programs that existed in Lakeland."

While the separation of the Lakeland campus has been in the news recently, Wiencek emphasizes that the university's focus is on the students. "The accreditation teach-out process mitigates many of the issues that students have," he explains. "Here in Tampa, we just want to say to all of our students that we will take care of them. We welcome them into the community of the College of Engineering and wish them well as they graduate."

The USF Tampa campus' College of Engineering will soon offer a new degree program in Information Technology. Both bachelors and master's degrees will be offered. The new IT program has strengths in both cyber security and robotics. The program will become a member of either Computer Science and Engineering or Industrial and Management Systems Engineering, with the College of Engineering Faculty Governance Committee making a recommendation to the Dean before the end of the year. It is expected that the Dean will forward his recommendation to the Administration shortly thereafter. "We are all in the process of getting a consensus and finding the right place for our new program," explains Wiencek. "This IT program focuses less on calculus," he continues, "in line with Information Technology programs in other universities. This feature will provide a significant alternative to some of our students that are struggling with calculus requirements in other degree programs. The students will now have more options to stay in the College of Engineering.

The new Information Technology program, and up to 10 new faculty, is the only program that is being transferred intact to the College of Engineering on the Tampa campus from the former USF Polytechnic in Lakeland. Other departments will also welcome new faculty: Chemical and Biomedical Engineering will add one professor whose expertise in renewable fuels will complement the department's extensive research in this area. Two more faculty will be added to Electrical Engineering, in radio frequency identification and power engineering. Several more will be added to Industrial and Management Systems Engineering to aid in teaching students still resident at the Lakeland campus.

"The bottom line is that we are welcoming 10 new faculty members, and we are excited about this development. This will add expertise in both cyber security and robotics, which complements our existing programs very well."

EE Professor Develops "SuperGlue" Polymer with Draper Labs

By Desa Philadelphia

Professor Wang and his graduate student research group.

Second Roll from Left to Right: Kevin Kellogg (PhD), Paula Algarin (PhD), David Bartholome (REU), Jing Wang, Julie Lutti (Post-Doc), Mian Wei (PhD), and Olawale Ajayi (PhD)

First Roll from Left to Right: I-Tsang Wu (PhD), Vinicio Carias (PhD), Tianpeng Wu (PhD), and Ivan Rivera (PhD)

Electrical Engineering Associate Professor Jing Wang has made persistent effort to seek collaboration with industrial organizations. After running into a colleague, who now worked for the Draper Laboratory, Wang realized that Draper sponsors advanced research on college campuses around the country through their prestigious University Research & Development (URAD) program with funding rates less than 15%. Moreover, he became convinced that his work in nanomaterials with tailored properties could be of great benefit to the Draper scientists whose work focused on heterogeneous integration of semiconductor devices into a single multi-chip module. "It was an intriguing prospect," says Wang, who added that Draper Lab had opened two new facilities in Florida adjacent to the University of South Florida campus.

The Draper Laboratory is known for its superb capability of bridging the gap between university research projects and real-world commercialization of that research. Meanwhile, Wang works in the area of nanomaterials, a field that is driving technological development. It seemed like a natural match, and both sides could see that.

But here is where the persistence comes in. Prof. Wang and the engineers at Draper weren't quite sure what they should work on together, and finding a common interest didn't come easy. It took more than a hundred emails back and forth, and quite a few conversations, before they settled on the magic project. "They really liked our capabilities but told us the objective would be to produce something very practical, (and asked) can you help us address that lingering issue?" explains Wang. "Eventually we realized what's needed should be an injection moldable polymer composite material with well-tailored thermal, electrical and mechanical properties, which could be shaped very easily. Then once the shape is determined you can cure this thermoset material to finalize the shape," he add.

Then some more streamlining followed. "We narrowed down that it had to be a composite with evenly dispersed micro-scale or nano-scale particles," says Wang. "And we had been working on nanocomposites for a while. I had some interest (in seeing) whether I could use the same technology but for a different application."

Professor Wang's group has worked closely with a group of Draper Scientists throughout the entire two year duration of this collaborative project funded by Draper URAD program. The work resulted in the creation of a nanocomposite material, a polymer filled with nanoparticles that after curing did not shrink much and did not expand much. Those properties made the polymer composites ideal for meshing with the silicon wafers for heterogeneous integration of semiconductor devices into a single chip. Wang says the result is that the polymer acts like "a superglue" for mounting components onto a silicon wafer and "for gluing the chips together onto a so-called multi-chip module. You can start connecting them together subsequently, known as interconnecting."

Draper Laboratory had previously had a material they were shipping in from overseas that, until Wang's project, was the best they could do in finding a, so-called, superglue. The material had some good properties but then there were others that would ruin devices. Wang's project funded by Draper Lab URAD program has held some promise to address these problems while providing technical knowhow.

"One of the things that we really achieved is we wanted this material to be temperature stable," says Wang. "The material we finally worked with could be stable up to 300 degrees Celsius. That's compared to 120 to 140 degrees for the material they had been using already. That's a big improvement and we're really happy about that." Another desired performance metric is minimum amount of thermal expansion. The material Wang's group generated had about a 20 percent lower thermal expansion coefficient than the previous counterpart material.

While Professor Wang is extremely excited about his polymer composite's potential to improve the multi-chip module technology in the future, by perhaps allowing more chips to be integrated onto a single substrate because they could be assembled closer together, he warns that this material is still far from ready to be used in production. For now he is focused on collaborating with his Draper colleagues to get the research published.

It's interesting to note that although Professor Wang began thinking of a Draper collaboration when the lab established outposts at Tampa and St. Petersburg in 2009—its first facilities outside of the environs of the Massachusetts Institute of Technology—because of the nature of the work funded by the URAD program he ended up working with colleagues who were based in Cambridge, MA. However, his group recently started working on another project by collaborating with Draper scientists in Tampa. Maybe one day in the future he will be partnering with even more industrial organizations beyond about a dozen companies he already worked with. So long there is a good enough research topic to provide his students practical training and learning experience, Professor Wang will surely, persistently, pursue it.

Mechanical Engineering Students Team Up with Chromalloy Castings on Senior Capstone Project

By Marcus Rodriguez and David Ramos

In an effort to magnify and enhance relations with the University of South Florida, Chromalloy Castings has teamed up with USF's mechanical engineering department in hopes of solving one of the facility's most notorious material handling issues.

A team of four students was taking part in its Senior Capstone Design project, a course aimed toward putting the concepts learned in the mechanical engineering curriculum into practice.

Although Mechanical Engineering's Capstone program is geared mainly toward projects dealing with rehabilitation, USF highly encourages students to partner with outside companies so as to ease the students' transition into the engineering industry and to offer companies innovative solutions to problems they may be experiencing.

Pictured at Chromalloy Castings (L. to R.): David Arague, Ryan Bernosky, David Ramos and Marius Rodriguez.

With the size and weight of molds ever increasing, Chromalloy has a vested interest in maintaining the safety and well-being of its employees as well as ensuring that the quality of its product is not compromised by poor material handling practices. Because of this, Chromalloy would like to introduce a policy whereby molds weighing in excess of 50 lbs. may no longer be lifted by hand.

Due to the manual lifting of molds weighing in excess of 100 lbs., a high volume of scrap is currently experienced in the Dewax and Mold Prep areas of the facility. In an attempt to create a system that can reduce the amount of scrap produced as a result of mishandling, the team designed a manipulator which utilizes components of a previously used machine that was not up to the task. The synthesis of fresh ideas and existing technology proved to be decisive and provided a means to lift, transport and rotate the molds 180 degrees.

In order to accomplish these tasks, the team designed a system where the molds would be lifted using forks, then clamped from the opposite end, enabling the mold to be supported from both sides during rotation.

The system was then attached to a back plate, which allowed the entire assembly to be bolted to the existing manipulator and to utilize the manipulator's existing motor functions.

The molds themselves also had to be altered in order to accommodate the lifting forks of the new manipulator. These molds were fitted with handling pipes flanking each side of the pouring cups. The new manipulator was tested with the new molds in green state and after having been fired in the furnace, both tests were successful.

This new manipulator now gives Chromalloy Castings a decisive edge in its ability to safely and effectively handle and transport the molds, and will drastically reduce the amount of scrap at the facility.

Professor Sagüés Pioneers Saltwater Corrosion Research — By Desa Philadelphia

Alberto Sagüés, Distinguished University Professor of Civil and Environmental Engineering, has spent the last 27 years battling Florida saltwater. Not that Sagüés doesn't like Florida's beaches. But as someone who has dedicated his career to protecting Florida's civil structures from corrosion, he is constantly battling the effects of salt and water on steel and concrete.

It may be impossible to completely prevent corrosion, but Prof. Sagüés is working on perfecting the process of controlling it. His work at USF has been focused on forecasting how corrosion will affect structures in the future so that a cost-effective plan could be adapted to better reinforce concrete with steel, or to better design structures to prevent corrosion.

Sagüés has nurtured a beneficial working relationship with the Florida Department of Transportation (FDOT). He does research aimed at the real-world needs FDOT encounters, and they readily implement the innovations that result from his research. "Most of the people at USF who work with the Florida Department of Transportation have a very productive and intense interaction with them," he says. "We participate in many of their technical decision-making discussions. They certainly use our results and many times when we prepare our research plans it's in close consultation with engineers from Florida DOT."

It is in part because of this working relationship that Sagüés has gained a reputation as a pioneer in the area of corrosion and durability of infrastructure engineering materials. In the last 27 years he has contributed to corrosion forecasting and prevention, by making extensive use of electrochemical assessment techniques. And because of the way he works with FDOT engineers, his work has real benefits for Florida taxpayers. "We are able to focus our work on the kind of things that are immediate needs of the DOT," he explains. "When there have been structural components that need immediate attention, people from our team have been at the bridge that needed evaluation, even overnight. We have had the privilege of working on research that has immediate impact."

Prof. Sagüés says he chose to join USF in 1985 because the university valued the research path he was embarking on. "Because of the environmental conditions of Florida this work was very much needed and I was excited to see that the university wanted to make inroads in this area of work," he says. "Few universities in the country have an emphasis in this direction. I must say that I haven't been disappointed at all. It was a fantastic choice to join the university."

In March 2011, NACE International, the preeminent society of corrosion engineers, named Alberto Sagüés "Fellow of the Association," an award that is only bestowed on about six of the organization's 25,000 members each year. Sagüés says the recognition is a boost to him, and to USF. "I am very pleased. The fact that they felt that the work that I conducted here was worth the honor is a testimony to the quality of the work we can perform here at the university and the fact that we are having a recognizable impact on engineering practice."

This was not the first time NACE International has honored Prof. Sagüés' work. The organization (which was originally called the National Association of Corrosion Engineers) gave him a Technical Achievement Award in 2010, which is aimed at recognizing members who have had made a difference in the practice of corrosion control.

Sagüés says his field has certainly grown in leaps and bounds in the last two decades. Consider that standard building materials have improved significantly. "A very good example is the fact that we now know how to make concretes that are one hundred times less permeable than they were 30, 40, 50 years ago, and at a cost that is not much greater," says Sagüés. Design has also improved, he says, so that structures are expected to last longer. "The design-service expectations for structures have progressed from say 25 to 50 years in the past, to at least 75 years today. Some structures like the Miami Port Tunnel now have a durability goal of 150 years, says Sagüés. "So we are talking about a century-class kind of durability," he adds.

He believes that what would really speed up progress is if corrosion engineering became standard in civil engineering education. He made this argument to the NACE membership in a roundtable article titled *Challenges in Sustaining the World's Bridge and Highway Infrastructure* that ran in the November 2011 issue of the organization's monthly *Materials Performance* magazine. "Infrastructure durability with a corrosion focus should be an integral part of the curriculum for civil engineers," he told the magazine. "At present, civil engineers with a structural orientation can easily graduate with little more than a brief introduction to corrosion fundamentals as part of an introductory course on engineering materials."

Sagüés can sometimes sound a little besieged. This is due in part to the enormity of the challenge his work confronts. "Florida has in the order of 6,000 bridges near saltwater and some of them are major structures like the Sunshine Skyway Bridge," he says. "We can't afford for those structures to not be durable and not be able to withstand the deterioration that happens." Undoubtedly, Sagüés is proud of his achievements and knows that the people of Florida have benefited from them. Preventing corrosion, he says, "is an engineering challenge." But he is quick to add that it's possible to be smart about how corrosion is forecast and how it can be prevented. The ability to do that, he concludes, "can pay off big time."

IMSE Adopts Comprehensive Mentoring: Coursework Won't Do it Alone for IEs

By Janet Dawald

Exactly what is industrial engineering? Armies of dystopian robots spewing sparks while a conveyor belt moves a perpetual river of mass-produced identical products? Come on, Blade Runner is thirty years old. The first department of industrial engineering in the United States, at Pennsylvania State University, opened its classrooms in 1909, at a time when mass production dramatically lowered the cost of everything from automobiles to watches. But in the last century, industrial engineering has evolved to keep pace not only with technology, but with humanity. Today, industrial engineers are concerned with disease modeling and diagnosis, healthcare systems, big data analytics, energy, entertainment, logistics, and public policy. It is a multidisciplinary approach to improving complex systems, integrating both physical and social sciences to benefit mankind.

Everyone involved in higher education, from freshmen to presidents, would agree that college is indeed a complex system. That is why Tapas K. Das, professor and chair of the Department of Industrial and Management Systems Engineering, started applying the concepts of industrial engineering to his own department. Besides offering a world-class engineering education, Professor Das is also dedicated to providing his students with all the opportunities and experiences that a university such as USF offers.

"We went about this is a very deliberate way," explains Das. "Our students are attending a large global research university. It has so much more to offer than just the courses they sign up for. Our students need to take advantage of these benefits now, because once they graduate and step out of the university, these resources mostly become unavailable."

The IMSE department had a strong tradition of mentoring. But the IMSE faculty, who are industrial engineers after all, wanted a standardized method that would introduce the students to a wide range of USF resources, activities and experiences. With Das' experience as an associate provost, the department faculty came up with a mentoring program known as the Building Blocks for Student Portfolio Development.

On the surface, the portfolio appears to be a simple checklist. It is divided into Leadership, Community Engagement, Mental and Physical Health, Language Competency, Global Experience, Undergraduate Research, Scholarships, and Life Skills. The IMSE faculty divides the department's students among themselves for mentoring. Each student is presented with a standardized blank portfolio, and 45 minutes of one-on-one with a professor in each advising cycle. Anticipating some blank stares, Das also provides a version that is filled in with a range of possibilities available to USF students. For example, the Global Experience heading lists almost a dozen suggestions, ranging in activities such as those organized by the Office of Multicultural Affairs all the way through to befriending one international student. Leadership includes activities at the Center for Leadership and Civic Engagement (CLCE) all the way to working at Engineering EXPO.

Prior to each semester, and before enrolling for classes, the students in this program fill out the portfolio with both goals and accomplishments. The portfolio is saved in their folder, along with transcripts. "When they come see us," says Das, "we spend five or ten minutes talking about classes, and then 30 minutes or more going over the portfolio. What they accomplished in the past semester, and what their goals for the next semester will be." Students are asked what their interests are, and receive information tailored to those topics. "If someone is interested in Hispanic culture, or Chinese culture, we refer them to both USF and community programs. When we see you them the next time, we try to ensure that they have taken full advantage of everything USF has to offer."

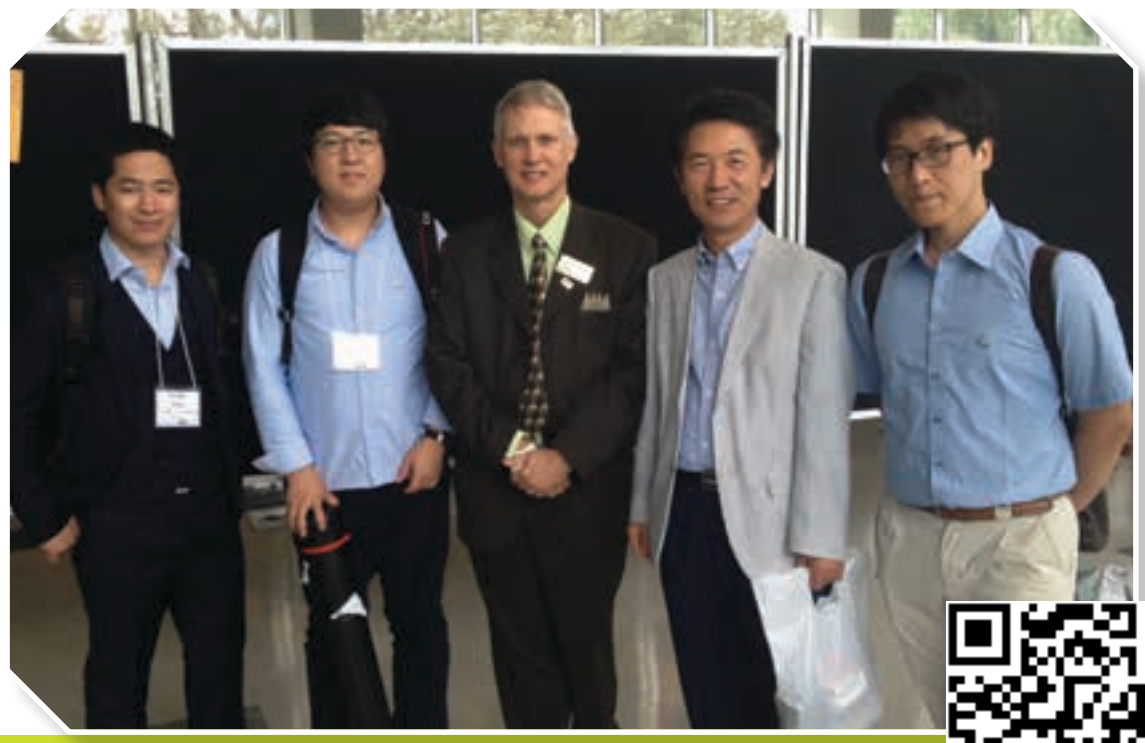
Not every category needs to be done in every semester; planning is part of the learning process. The goal after two years is to have a balanced Portfolio that reflects not only engineering skills, but the experiences that will make them stand out.

The portfolio also serves several other purposes. "When you contact me for that letter of recommendation," explains Das, "I am going to look at your transcripts and your Portfolio, and I will write my letter on these two documents. It is up to you to build your Portfolio." Obviously when your professor can see that you volunteered to

Research News

College of Engineering Research Day 2012

Dean Wiencek welcomed a group from Kangnam University in Yongin, South Korea that participated in the 5th Annual College of Engineering Research Day 2012. Pictured left to right: Eung-ju Shin, Dong-Wook Shin, Dean Wiencek, Professor Seung Ho Cho from Kangnam University in Korea and Young-Hyun Lee. Eung-ju Shin and Young-Hyun Lee, students at Kangnam submitted: Laboratory of Fuel Cell Applications and Automotive Electronics.



For more information about Research Day 2012, use your smart phone's QR reader.

tutor, or served as an officer of a professional society, or even became an opera buff, your letter of recommendation will be a stand out in a sea of boilerplate responses.

Anyone in recruiting or management will recognize the Portfolio as a framework for a well-rounded resume. Leadership, community engagement, all of the extraordinary experiences that go into making a student an asset to an employer are covered.

Professor Das also points out that many students simply do not know of all the possibilities that USF offers. He notes that the former Indian President Dr. A.P.J. Abdul Kalam recently delivered a lecture at the Patel School of Global Sustainability. "Image getting an email about this," he ponders. "Your tuition has bought you the privilege of taking a seat in that lecture hall. Where else will you get this opportunity? Will you just hit the delete key?" With a touch of pride he adds: "I saw some of my students there, asking questions. These are the advantages we want to give our students in our mentoring program that they may not be aware of."

The portfolio and mentoring program officially began in the fall of 2011. "We are all learning as we go," adds Das. "Many of the students have experience in these things but do not realize it. I ask them if they did volunteer activities in high school or were part of student government. Well, that is leadership that is community engagement. I also ask how many hours the student has to work, where he or she lives, what are their goals. Students are often amazed that our department professors ask these questions."

The IMSE department plans on using their traditional exit interviews and will follow up on graduate success to refine the project and help gather statistics. "To my knowledge, this is the only comprehensive mentoring program like this," says Das. In the meantime, he encourages all USF students to take every advantage that a global research university like USF has to offer.

Engineering Alums Are Excelling at Boeing — By Janet Gillis

The college has numerous alumni working at some iconic engineering corporations such as Boeing, Lockheed Martin, Intel, Northrup Grumman, just to name a few. Students often want to know how to connect with these companies and make the leap from student to engineering professional. Envision recently spoke with some recent graduates who successfully made the transition from student to Boeing employee. **Angelique Waller** '12; **Maria Oehlert PhD** '12; and **Richard Stokes** '08 MSME '10 provide some inside information on their experiences as Boeing engineers.

1. What pathway took you from USF to Boeing?

Angelique: I went to a HENAAC conference in Orlando and attended Boeing's networking suite to meet with hiring managers. The next day at the career fair I interviewed with another manager. After that interview, I received an invitation to a plant visit and then was offered a position.

Richard: Although my first Boeing interview in 2010 didn't result in a job, in early 2011 I received another interview with Boeing in Washington as a structural designer in the commercial airplane division. I am currently working in Boeing's Commercial Airplanes Propulsion Product Development Group.

Maria: I attended job fairs where Boeing and other companies of interest to me were participating. My path to Boeing comprised searching and applying for as many positions as possible in my field of my interest. I attended professional assessments, followed by structured interviews and got an offer.

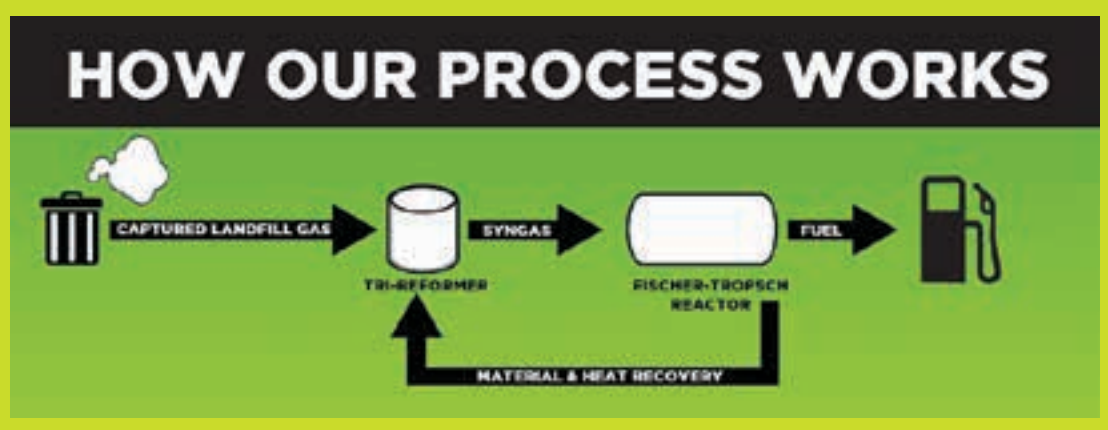
2. What in your academic experience most prepared you for your career at Boeing?

Angelique: There are many, but the most important was in-depth group projects at USF. This gave me the experience to, not only, accomplish a task with a variety of personalities, but also to recognize my own strengths and

continued on page 15

Sylvia W. Thomas, assistant professor in the Department of Electrical Engineering, is the principal investigator of three new NSF awards in the amount of $254,188.

A student-led College of Engineering start-up company that converts landfill gas to liquid fuel won the $100,000 grand prize at the second annual MegaWatt Ventures Clean Energy Business Competition, sponsored by the U.S. Department of Energy. Trash2Cash-Energy's proprietary process converts naturally produced landfill gas (composed mainly of methane and carbon dioxide) to high-value liquid hydrocarbon fuels, such as gasoline, diesel, or aviation fuel, based on the needs of the customer. Founded this year by USF doctoral candidate **Syed Gardezi**, recent graduates **Timothy Roberge** and **Devin Walker**, and faculty members **John Kuhn** and **Babu Joseph**, Trash2Cash has an option to license the technology through USF.



Collaborative Research Group Receives Multiple Patents for GPS Tracking

— By Janet Dawald

In July 2005, London commuters witnessed the dark dawn of a new era. Fifty-two people were killed and 700 injured when four suicide bombers carried out a coordinated attack on the London Underground and bus system during morning rush hour. Emergency communication systems malfunctioned much as they had during the attack on the World Trade Center four years earlier. What did work was the cell phone system, which was inundated by voice and video calls from victims, witnesses and relatives. Police responded to these calls, not knowing exactly where they were originating from, as callers themselves did not know precisely where they were within the underground system. The overloaded wireless network in the immediate area was actually shut down by the London Police. This was the first time, and still is the benchmark, where citizens armed only with cellphones are the first responders to disasters.

Philip Winters, Transportation Demand Management Program Director at USF Center for Urban Transportation Research (CUTR), describes a new paradigm where more security information will soon come from "the eyes and ears of the general public." So how does CUTR, a nationally recognized resource in transportation expertise, relate to mobile phones? But CUTR holds seven patents that have far-reaching applications from public transportation security to helping disabled public transit passengers find the correct bus stop.

In the mid 90's, CUTR used a traditional method of tracking people's movements with paper activity diaries to test efforts to influence travel behavior to help reduce congestion and vehicle emissions. Participants recorded their daily trips, noting when and where they traveled, how they traveled, and the purpose of their journey. Understanding current behavior is important for change to occur. The researchers found that providing personalized feedback to each household in the test group did change their travel habits. "Obviously, the use of paper diaries and manual analysis of the data was not a sustainable method for wide scale implementation," explains Winters. "We sought to automate the data collection and provision of suggestions based on that data rather than more generic advice based on a "typical" day."

"There are not many typical days for people anymore," he explains with a laugh. "Even then we were pushing it to think people would keep track of travel for seven days using a paper activity diary to get a fuller picture of travel habits. We needed a less onerous way to collect this data."

CUTR decided against using GPS technology that was installed in people's vehicles. "That," explains Winters, "only tracked the car, not trips made by bus, bike or walking." What was needed was a device that people could carry at all times, something small and relatively inexpensive.

Sean Barbeau, PhD, Principal Mobile Software Architect at CUTR, picks up the story. "We needed to develop the next-generation travel activity diary. We needed the fine-grained information that paper diaries cannot provide. So we started looking at GPS-enabled cell phones. Could we piggyback on top of these commercially available devices? We would compensate the cell phone user with some type of service in exchange for their travel information." With the assistance of many students from the Dept. of Computer Science and Engineering, including students from the Research Experience for Undergraduates program, CUTR developed a travel activity diary mobile application, "TRAC-IT", and tested prototypes and addressed privacy issues. There were just two hitches.

The hitches are familiar to anyone who has waded through a 28-page wireless phone bill or watched the little battery icon go from green to red, right before the screen goes black. Data and power.

"When you have the GPS feature turned on for real-time tracking apps," explains Barbeau, "every few seconds your phone calculates its location and transmits your location information over the network. Every time that happens, both your battery and your data plan take a hit. It is often too much data for our purposes."

Basic telephone conversations do not require this GPS information to be sent. However, when you use an application that requires GPS locations, like a turn-by-turn navigation or real-time tracking app, the phone fires up the GPS system and starts transmitting this data over the network. "Foursquare, Google Latitude, all those location-based social networking apps also use this same basic design of locate and send," explains Barbeau. The result is large amounts of data sent from the cell phone to the servers. "Imagine sending hundreds of thousands of cell phone locations to a server every few seconds," he continues, "it's too much. What we are doing at CUTR is working to conserve the amount of data that is transmitted. We've been developing algorithms aimed at both intelligently reducing the frequency of GPS calculations and data transmissions, which will save battery life and not eat into your data plan."

For humans, it is easy to tell if you are moving or not. For a device, it takes a considerable amount of computing power. A patent was issued to CUTR in 2011 for an algorithm, "GPS Auto-Sleep," that is able to reduce the amount of location data sent, and conserve battery life, yet still maintain accurate user tracking. Instead of locating the user constantly every four seconds, the algorithm samples the user's position at different intervals relative to whether the user is moving or stationary. When the user is in close proximity to the previous location, such as sitting in class or an office, the algorithm methodically increases the time between GPS fixes. When movement outside the user's last known proximity is detected, the program resumes collecting data again more frequently.

CUTR's most recent patent, the "Method for Determining Critical Points in Location Data Generated by Location-Based Applications" is the latest of seven patents issued to CUTR and the University of South Florida. This patent was awarded for an algorithm that reduces the number of location data transmissions from a mobile phone while still maintaining an accurate representation of the user's travel path. It joins six other patents that include algorithms to create ridesharing arrangements, a mobile app "TAD" that helps disabled people navigate a transit system, an algorithm that helps these individuals identify their upcoming bus stop, an emergency locator system that enables authorities to communicate location-specific messages based on the user's real-time location (something that would have assisted in the London incident), and an emergency reporting system that would capture images or videos from cell phones and transmit them to law enforcement.

Cell phones transmit location data only when asked to do so by the user or an app. However, some of the technologies of the future would depend upon all cell phones transmitting some degree of location. For example, to send out information about a traffic problem on I-75, the system would need to broadcast only to those cell phones within close proximity of the problem. For an Amber Alert program, a dispatcher could select a geographic area where a missing child was reportedly seen to forward an image and description of that child to the mobile phones of people in that vicinity. Campus notification systems would not depend upon a list of subscribers' phones, but would know the geographic location of the campus and target the emergency calls to all phones in the area. However, these amazing programs all depend upon knowing the location of the cell phones. CUTR's research and development in keeping our cell phones on a data diet will also pave the way for these smart location-based systems to become reality.

HSA Engineers & Scientists Give Students "Real World" Experience

— By Desa Philadelphia

Working in a lab environment, it's easy to concentrate on making sure everything is done correctly, even if it means running the same experiments over and over and over again. In the real world, doing the same tests more than once could be the difference between financial success and bankruptcy.

It might seem like a common sense calculation, but lessons like these aren't usually learned until engineers are already on the job, and usually not until they experience the hard knocks of costly mistakes. But thanks to a growing partnership with local firm HSA Engineers & Scientists, University of South Florida students are already getting free lessons in the costs of real-world engineering.

HSA began life as HSA Environmental, Inc. an environmental consulting firm founded by engineering alumni Nick Abergo and Dave Scott. Following a merger with another Tampa-based land surveying firm, Scott-Sims and Associates, investment from global environmental firm Conestoga-Rovers & Associates, and a series of acquisitions, HSA has grown to 300 employees in 14 offices across the southeastern United States. Despite their new roles as globetrotting consultants, however, President Abergo and company Treasurer Scott, have maintained strong ties to USF and have prioritized giving to the College of Engineering and its students.

For one thing, Scott and Albergo established their offices on Fowler Avenue, across the street from the engineering facilities and regularly recruit USF graduates to work at the firm. The partners recently donated $100,000 toward renovating the USF Engineering II building, to include a multi-disciplinary learning center that is being called the "educational epicenter." Even more valuable is that this year Albergo became an adjunct Professor of the Practice in the Department of Civil and Environmental Engineering, teaching classes on environmental site assessment and environmental field sampling. His classes are designed to give students insight into the real world of engineering consulting, and Albergo takes students on field trips to current HSA work sites.

"He took us on a field trip to a laboratory that does analysis of water and soil samples," says Arlin Briley, who earned a master of civil engineering at USF and is now pursing a PhD in environmental engineering, adding that the goal of the work was to identify where pollutants were originating and where they were spreading to. "We spent three days working with a professional environmental technician who walked us through collecting water samples," Briley says the field experience helps students envision themselves as professionals. "It's very valuable to have that current, real-world perspective. In a classroom setting we can only go so far in trying to understand what we will have to do in our future careers. Just one day in the field with Mr. Albergo gave us the opportunity to step through some of those processes, experience it for ourselves." Briley says the field work with Albergo really helped students to realize "what kinds of training we want to seek out."

USF Engineering associate professor Maya Trotz pointed out that Albergo "uses his own equipment and staff to help train our students. HSA sponsored our AEESP (Association of Environmental Engineering and Science Professors) conference and Albergo presented at the conference." She said the attention he gives the College of Engineering, and its students, "lets our students see that USF is graduating environmental engineers who are among the most successful in the field." And that message, she says, is critical to the college's education mission. "We are trying to prepare students to be globally competitive and his experience, and his example, are critical to helping our efforts."

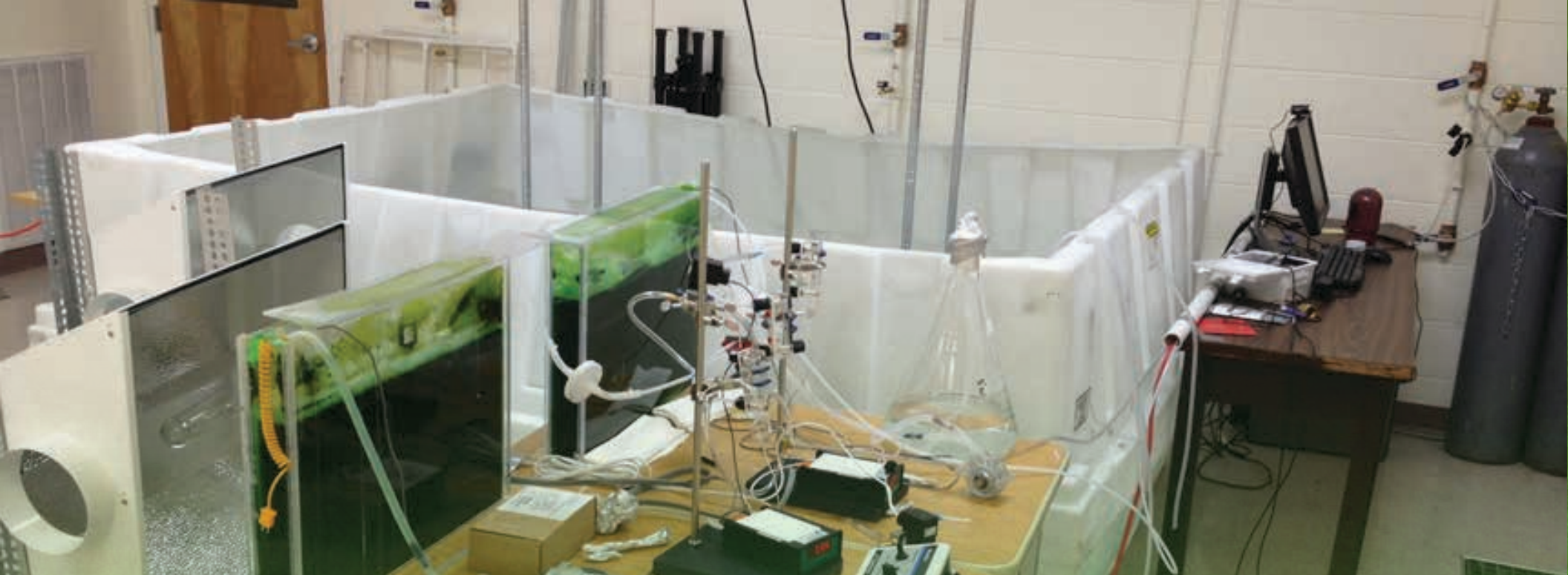
While Albergo's field trips are first and foremost about giving students the opportunities to observe real work sites, they also serve as teaching tools because he doesn't shy away from talking about issues like budgeting, including how doing an experiment more than once can lead to diminished returns.

This focus on professional, field experience has made Albergo very popular with students. They also appreciate his fun-loving approach to learning; and to business. As do his employees. This year HSA was named one of the Tampa Bay Times' Top Places to Work. The paper mentioned Albergo's preference for khaki shorts and polo shirts and company events like 500-person tailgate parties, golf tournaments and cook offs. "We work hard and we play very hard," Albergo told the paper.

Albergo has always been keen on tempering the challenges of engineering. While a student at USF he came to class barefoot, brought his dog along, and regularly parked in the dean's parking spot. His parking spot at HSA's Fowler Avenue offices is marked with a sign that reads "Dean of the College of Engineering." Employees know it's OK for them to park there.

But below that fun-loving exterior is an acute acumen for engineering, and for business. And HSA has the high-profile portfolio to prove it. When a large sinkhole destabilized a Tennessee elementary school in September, the company was called in and worked around the clock to diagnose the problems. This year both Inc. magazine and, for a third time, Zweig White, which produces business services to architectural, engineering and environmental consulting firms, named HSA to their lists of the fastest growing companies in the United States.

While students find Abergo's (and HSA's) accolades impressive, at the end of the day what matters to them is being able to have fundamental work questions answered by someone who is one of the best. "It's pretty exciting to work with an engineer who is a leader in his field," says Briley. "It's like being able to ask someone you know how was work today. What were the challenges you experienced and what should we prepare for."



The GROWTH of Algae Biofuel

By Tom Edrington

Now is the time to begin the movement, seriously. The United States has put some initial pebbles on the path to energy independence, but it has been mostly talk. Now is the time to get serious.

University of South Florida Associate Professor George Philippidis is on a mission to do his share to rescue us from the prison of expensive imported fossil fuels. Now is the time and USF is his place. He spent nine years as the Energy Director of the Applied Research Center at Florida International University before coming to USF.

His energy career started at the National Renewable Energy Lab (NREL) in Golden, Col. After that, he picked up valuable corporate experience as Director of Biochemical Development for a subsidiary of Thermo Fisher Corp in Bedford, Mass. It has been a long journey to USF but he's settled in and ready to help put this school on the biofuel map.

"Biofuels! It's one of our big things. It is the 21st century and the leadership here at USF recognizes its place as a leader in green technology and research and I'm thrilled about that," says Philippidis, who has been with the school for a year and is in the midst of preparing to take his work and research to the next level.

He has a world of alternative energy sources in his repertoire. "There's solar, there's biofuel, natural gas and we're doing work with algae as a great potential source for fuel," he pointed out.

The term "biomass" is heavy in his world. It's anything green. "We target inedible biomass, the fiber of all kinds of things out there, like bagasse, a by-product of the sugar cane industry. It can be converted first to sugars and then the sugars can be fermented into biofuels, plastics, and even hydrocarbons," he explained.

Florida Crystals, owned by the powerful Fanjul family in South Florida, is aboard with the technology and the research. There are also other types of crop residues that come into play," Philippidis said. "Citrus peel, corn stalks, wood chips, even yard waste. Too much yard waste is going into landfills and we need to take it out of the landfills and convert it to better uses."

One of Philippidis' fascinating areas of research is the use of algae. What most of us consider "pond scum" he considers a great potential source for green energy. "Algae are interesting because they don't grow roots. You can grow them on land where you can't grow anything else. All it takes is sunlight, water and carbon dioxide and the water can be polluted water that has no other use," he said with an obvious tone of excitement in his voice as he talked about the possibilities.

Philippidis has been working with his algae projects at an off-campus indoor and outdoor facility but that is about to change. He's working to bring his indoor lab and outdoor facility to campus so that he can get more students involved with his research.

"I want to close the gap between university research and commercial arena," he said. "We are working on a lot of innovations that can help the real world."

The "real world" is looking for help. The United States Department of Energy is gearing up its efforts. "And every oil company has some stake in all of this," Philippidis said. "BP (British Petroleum) is into solar and biofuels, Exxon is into algae. The auto companies need to move closer to producing more hybrids, one day that's all they will produce, vehicles that run on multiple fuels - electric or biofuel or natural gas."

There is one major sector within the United States that has a very strong interest in the potential for algae and its ability to produce fuel and that would be the U.S. military.

"The military is the single largest user of liquid transportation fuel," Philippidis observed. "It is in our national interests to steer ourselves away from dependence on the oil producers in the Middle East. The military has the biggest stake in all of this. It would be nice if we could avoid conflicts arising around the world because we have to protect the oil interests."

Along with the military, the aviation industry has its hand in the algae solutions to high-cost aviation fuel. The European Union is targeting the year 2050 to have 80 percent of its aviation fuel be biofuel. That may be more than 30 years in the future but at least it's a goal. "One of the problems is that aviation fuel is expensive and causes high-altitude pollution," Philippidis pointed out.

So where does Florida fit in? What does the Sunshine State offer to help solve these world energy issues?

"We are currently looking for partnerships with the utility, cement, agricultural, and phosphate industries here in Florida," was Philippidis' answer. "Those companies own land, they generate carbon dioxide and they have waste water, all the necessary ingredients to mass produce algae and convert them into biofuels and they are interested."

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And that use of algae doesn't stop with fuels either. Every year we read about droughts and how they affect crop production in the United States. When crop productions are hurt, such as the recent fallout in the corn production, there are consequences such as the predicted world pork shortage.

"The great thing about algae is that they can also produce animal feed so that farmers won't be dependent exclusively on corn crops to feed their animals," Philippidis said. "There is so much good that can be accomplished."

Those farmers are also a future source for energy production. "Farmers in the future will be able to produce not only food, but energy as well," Philippidis said. "They can improve their own productivity by using land that may not be suitable for crops and they'll be doing something to help the world energy crisis."

The key for all of this to happen is to bring down costs to produce and convert algae to the point where it is more economical than refining imported petroleum. Philippidis, who owns 11 U.S. and world patents in clean technologies and has filed for his 12th last June at USF, knows that the process will take time. "I have no illusions that this will happen overnight. But what we're doing is all about sustainability, not to just produce and protect our food, water and environment."

There are naysayers who believe this is all too futuristic, but Philippidis begs to differ. "A lot of people still think it's early so funding isn't a slam dunk," he said. "We now have plans to scale up algae production in landfill areas where people already burn methane, a by-product from the landfills and generate CO_2, which will be directed to algae ponds."

Spend some time with Philippidis and it's impossible not to sense his overall enthusiasm and excitement. That enthusiasm is now headed for the main campus. "We are real-world problem solvers. It is great for the university. We want to be the go-to university for the private sector to seek out and to make it all happen," he said, smiling.

"Hopefully, things will begin to change and we'll be a big part of it. "If we don't," he declared, "who will?"

Heart of Gold Scholarship Luncheon

On Friday, September 21, over 200 students and the donors who supported them, gathered to celebrate the 19th annual Heart of Gold Scholarship Luncheon. Students had the opportunity to converse and say thank you to the individuals and companies who helped them achieve their full potential both academically and professionally through these scholarships. New to our program this year was a printed program with more detailed scholarship histories along with personal quotes from the donors.

We thank all of our donors for participating and supporting student scholarships. As the 20th anniversary of the luncheon approaches in 2013, we hope to see all of our current benefactors along with some new ones at the luncheon. If you would like to submit your scholarship history for inclusion in the program, please contact: Marcy Kornfeld, Marketing Coordinator & Events Planner at mkornfeld@usf.edu.

For more information about Heart of Gold, use your smart phone's QR reader.

For more information about Bullarney, use your smart phone's QR reader.

alumni&students

ALUMNI NEWS

Margarita N. Dominguez '75 was recognized as a Top Hispanic Woman in Information Technology by Hispanic Engineer & Information Technology. Margarita started as an associate engineer at Tampa Electric in 1975. She held several leadership roles and in 2001 was named vice president of Information Technology and Telecom Services. She retired in 2006.

Javier Pulecio, '10 PhD Electrical Engineering, was the featured speaker for the 2012 Scholars of Excellence program sponsored by the USF Graduate School April 20.

Cindy Bethel, '09 PhD assistant professor in the Department of Computer Science and Engineering at Mississippi State University has been awarded an EAGER grant from the National Science Foundation (NSF).

Shawn Morin '87 was recently named Chief Operating Officer for the Ingram Content Group Inc., Franklin, TN.

John J. Desmond, Sr., '93 MSEM, passed away August 15 at the age of 92. John and his wife (the late Janina) endowed two scholarships in the College of Engineering in memory of their son John, Jr. who was killed in the Vietnam War. One scholarship is awarded to a student pursuing a bachelor's degree in mechanical engineering, and another for a graduate student pursing a master's degree in engineering management.

Mechanical engineering alumnus, **Mark Mondello**, '87 was recently selected to become Chief Executive Officer of Jabil (NYSE: JBL), an electronic product solutions provider in St. Petersburg. Mark started his career with Jabil in 1992, holding many leadership roles during that time.

Jaclyn A. Shepard '06 received her PhD in chemical and biological engineering at Northwestern University. Her PhD work focused on the development of new biomaterials capable of drug delivery to target nerve regeneration.

Ganna Chornokur, PhD, **'**09 was awarded a two-year Department of Defense Postdoctoral Health Disparity Training Award to conduct prostate cancer research at the H. Lee Moffitt Cancer and Research Institute.

Suzette Aguilar '06, MSEE '08 completed her PhD in electrical engineering at the University of Wisconsin, Madison. Her dissertation focused on experimental applied electromagnetics, with an emphasis on the development of a 3D sensor array for microwave imaging.

Nuvala Fomban, '07 MSBE, a graduate of the Department of Chemical and Biomedical Engineering, is the recipient of a NIH funded fellowship at the University of Washington.

Roland Okwen, a '09 tPhD graduate in the Department of Civil and Engineering and Reservoir Engineer at the University of Illinois at Urbana-Champaign's Illinois State Geological Survey, is the principal investigator of a grant from the U.S. Department of Energy's National Technology Laboratory (NETL).

Gita Iranipour and Dean Wiencek

Corporate Ambassador of the Year

Congratulations to **Gita Iranipour**, '02 MSCH, '04 PhD, for earning the EAS trophy for the second year in a row. Beginning this year, Gita is the CAP Coordinator. For more information on getting involved in this program contact her at iranipour@hillsboroughcounty.org. She is pictured here receiving the trophy from John Wiencek, Dean of the College of Engineering.

Sheila Carpenter Van Dyk, '96 Past EAS Chair and Robert Andrew, '86, '92 Current EAS Chair with the award

EAS Receives Golden Star Award

The Engineering Alumni Society was awarded the Alumni Association's Golden Star Award for excellence in five alumni group content areas during the 2011 academic year: Communications, Programming, Membership, Student Support and Group Organization. EAS received the award during this year's homecoming celebration.

STUDENT NEWS

At the May 5, 2012 Spring Commencement Ceremonies, the College conferred these degrees: BS: 293, MS: 118, PhD: 25.

Outstanding Graduating Seniors May 2012

- Chemical Engineering: Kyle Cogswell
- Civil Engineering: Gabriele A. Dionne
- Computer Science & Engineering: Jose Eduardo Cadena Pico
- Electrical Engineering: Jean Marie Weatherwax
- Industrial Engineering: Shannon Arant
- Mechanical Engineering: Matthew Clevenger

The **USF Student American Institute of Chemical Engineers** (AIChe) won the Outstanding Student Chapter Award for 2011-2012 academic year. They received the award at the national AIChe annual meeting in November. The faculty advisor is Associate Professor **Ryan Toomey**.

Adrian Johnson, a doctoral student in the Department of Computer Science and Engineering, is the recipient of a prestigious NSF East Asia Summer Pacific Institute (EASPI) fellowship to conduct research in China.

Michael Esteban and **Ileana Wald** were each awarded a National Oceanic and Atmospheric Administration (NOAA) Ernest F. Hollings (Hollings) scholarship.

Marie Chenowith, a spring 2012 graduate of the Dept. of Mechanical Engineering received the 2012 Helen and Clarence Prince Scholarship.

A team of civil engineering students took first place in the annual Traffic Bowl sponsored by the Institute of Transportation Engineers (ITE) at the organization's summer meeting held June 14 in Daytona Beach. The team was comprised of graduate students **Menna Yassin, Lyndonia Smith, Kyle Taniguchi** and alternate **Qing Wang**, current USF ITE Student Chapter president.

Trishelle Copeland-Johnson, a senior majoring in chemical engineering, has been awarded the 2012 NOBCChE Winifred Burks-Houck Undergraduate Leadership Award.

Sandy Pettit, a doctoral candidate in the Department of Chemical and Biomedical Engineering, has been awarded a USF Signature Research Fellowship.

Innocent Udom, a doctoral student in the Department of Chemical and Biomedical Engineering, received a NASA sponsorship to give a talk during the 63rd International Astronautical Congress (IAC), October 1-5, in Naples, Italy.

Nicole Smith, a senior civil engineering student, returned to classes this fall with a better understanding of professional engineering after a 12-week internship at Greeley and Hansen in Chicago.

Three doctoral students, **Bijith Mankidy, Anand Kumar Santhanakrishn**, and **Houman Yaghoubi**, received first place awards for their presentations during the NanoFlorida 2012 conference, September 28-29, at the University of South Florida.

Two student teams from the University of South Florida's civil and environmental engineering program competed in the Water Environment Federation Technical Exhibition and Conference (WEFTEC) national student design competition in New Orleans on September 29, 2012.

Green Solutions, consisting of students **Micah Blate, Danielle Bertini** and **Lyudmila Haralampieva**, took first place in the Environmental Division. **Emily Patrick** and **Gabriele Dionne** contributed to the project but could not attend WEFTEC. The clients for the project were City of Tampa Stormwater

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Student News — cont'd.

and Parks and Recreation Departments. The team won in the environmental design category at the Florida Water Environment Association (FWEA) design competition held on April 22 at the USF Tampa campus.

BioBull Solutions, consisting of students **Robert Gaylord, Matthew Munz, Yasmin Eskandari, Esteban Zajia Viera** and **Justin Terry**, took third place in the Wastewater Division. Their team worked on improvements to the Hillsborough County Biosolids Management Facility (BMF). The team won in the environmental design category at the FWEA design April competition.

FACULTY & STAFF NEWS

Structural Engineering Professor **Rajan Sen** was named a Jefferson Science Fellow for the 2012-13 academic year. Sen, who holds the Samuel and Julia Flom Endowed Chair, will spend the year at the U.S. State Dept. serving in an advisory role.

USF Provost, Ralph Wilcox, recently announced that Professor **Yogi Goswami**, the John and Naida Ramil Professor of Chemical and Biomedical Engineering and director of the Florida Energy Systems Consortium in the College of Engineering has been named Distinguished University Professor for 2012.

Mechanical Engineering Professor **Muhammad Rahman** was elected to the Chair of the Strategic Planning Committee (SPC) of the ASME Technical Communities Operating Board (TCOB) for a three-year appointment.

Venkat Bhethanabotla, professor and chair of the Department of Chemical and Biomedical Engineering was recently elected a Fellow of the American Institute of Chemical Engineers (AIChE), for his contributions to research in chemical and biological sensors, and computational materials science, education, and service to the Institute and profession.

Computer Science and Engineering Professor and Chair **Lawrence Hall** received the 2012 Norbert Wiener award from the IEEE Systems, Man and Cybernetics Society at the IEEE International Conference on SMC in Seoul Korea on October 16, 2012. This penultimate research award from the society is "To recognize significant contributions to research in systems science and engineering, human-machine systems, and/or cybernetics."

Department of Industrial and Management Systems Engineering Associate Professor **Kingsley Reeves** was selected to attend the National Academy of Engineering's fourth Frontiers of Engineering Education symposium in October in Irvine, Calif.

Harvey Kaylie – Entrepreneur, Philanthropist, Global Leader in the Microwave Technology Industry

Harvey Kaylie, founder and president of Mini Circuits, Brooklyn, NY, poses with President Judy Genshaft shortly after receiving an honorary doctorate of engineering at the summer 2012 graduation ceremonies. His commencement speech told graduates to, "Shoot for the Stars."

Mr. Kaylie is committed to engineering education and has been a generous supporter of the Wireless and Microwave Information Systems lab (WAMI) within the electrical engineering dept. since 1997. Donations of equipment from Mini Circuits have provided students with real-world experiences. His continued financial support for scholarships has helped 1,500 electrical engineering students complete their degrees.

Engineering Alums Are Excelling at Boeing — cont'd.

weaknesses that I brought to a team. My experience with Machine Design and using CAD software helps me with my day-to-day tasks at Boeing.

Richard: Although my research at USF was on heat transfer and thermo-fluids, I work as a structural design engineer, using CATIA (a CAD program) designing innovative architectures for future airplane programs. The learning, research, and presentation skills I acquired at USF have been priceless. I still use statics and mechanics of materials on a daily basis. My experience with ProE and SolidWorks definitely helped in the transition to CATIA.

Maria: Developing research skills and the ability to work in multidisciplinary teams prepared me the best. My job at Boeing involves participating in projects scoped to meet actual and future needs in industry, using a collaborative effort among representatives of many different groups.

3. What extracurricular activities did you participate in when you were at USF?

Angelique: I played on the USF Women's Soccer team for four years and was a member of NSBE, and Circle of Student Advisors which gave me the experience of working first hand with higher authority at USF. I believe my broad involvement, outside of maintaining notable grades, set me apart from other applicants.

Richard: I was an active participant with the Society of Automotive Engineers (SAE) team; working on both the Formula and Baja cars. Later, I was an active member and officer in our Tau Beta Pi chapter.

Maria: I participated as an active volunteer in industrial engineering recruitment activities such as Engineering EXPO giving demonstrations and lab tours; working with the STARS program; volunteering at USF / HCC summer camp; participating in the Stampedes of Service with INFORMS.

4. Did you have a mentor here that inspired you to work at Boeing?

Maria: I received guidance from adjunct professors and faculty members. One mentor, in particular, works for a company in the aerospace sector. I was inspired by his passion for his profession and work ethic, and how fulfilled he feels with his professional path

Angelique Waller

Maria C Oehlert

Richard Stokes

Angelique: I was influenced by Melanie Sutherland and classmate Yohannes Samuel who were both a great inspiration and motivation to me. My mentor Bernard Batson, associate director of student services, opened up opportunities that I didn't even know were out there; but he also allowed me to realize the importance of contributing and lending a helping hand in order to expect others to want to contribute to my success.

Richard: I did not have a mentor other than myself and my family that led me to Boeing. I visited the Boeing factory in Everett in 1994 and ever since I have had a desire to work there.

The Last Word on Working at Boeing

Richard: Boeing mainly hires through its internship and recruiting efforts by sending representatives to career fairs at schools like the University of Michigan with the express purpose of hiring, either for full time or internships. I would like to see Boeing engage with USF.

Angelique: Boeing has a vast array of fields with a plethora of positions on the defense side as well as commercial. Being so large, you have opportunities to move within the company where you see fit. The technology is cutting edge.

Maria: Boeing has many opportunities for many disciplines in engineering as well as many other areas within the company for professional growth. Having options when trying to build your professional career is certainly an advantage when working for Boeing.

COLLEGE OF ENGINEERING at the UNIVERSITY OF SOUTH FLORIDA
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USF: UNSTOPPABLE
College of Engineering

Beth Creed Fontes
Director of Development

The College of Engineering Development Office has had a busy 2012. With this edition of Envision, Beth Fontes, former Associate Director of Development is now the Director of Development, along with the addition of Major Alston. Major was Director of Development for Student Affairs but has brought his skills and talents to the benefit of the College of Engineering. We welcome Major to the College.

As we wrap up 2012, the College has seen significant investment from major donors and alumni. **HSA Engineers and Scientists** made a significant donation to the renovation and named the lecture hall the HSA Engineers and Scientists Educational Epicenter. **Gordon and Paula Gillette** created the Gordon and Paula Gillette Engineering Endowed Scholarship Fund. **Dr. Vasant Surti** created an endowed scholarship in Civil Engineering as well as a faculty fellowship in Civil Engineering. We are grateful to these individuals for making significant investments in the College.

Agilent gifted the College $26,000,000 in Advanced Design Systems software packages again this year. In addition to helping students learn about wireless circuit design, students that graduate with a BSEE degree with basic training in ADS are very attractive to potential employers. The WAMI Lab received a donation of nine high frequency vector network analyzers from Mini-Circuits, a global leader in RF, IF and microwave signal processing products, and Agilent, a world leader in test and measurement equipment. These instruments are used widely in industry for microwave test and measurement and will further enhance the real-world experience of electrical engineering students. In August, Mini-Circuits president, Harvey Kaylie, came to campus to receive an honorary doctorate for his work in the wireless and microwave industry. We are honored to recognize industry leaders like Harvey Kaylie who are involved in our College.

Through benefactors to the College, we have been able to expand our ability to serve our students. Donations, large and small, are vital in helping the College reach its goals. If you haven't been involved in the Engineering Alumni Society, consider helping with Bullarney this year. The Bullarney committee is just getting started, or serve as a Corporate Ambassador and be a link between your employer and the College of Engineering. For more information on how to get involved, contact Beth or Major.

It has been an amazing year and we are thankful for all of our alumni, faculty, staff and donors who have supported the College during the past year. Your help makes USF and the College of Engineering ***Unstoppable!***

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USF College of Engineering
USF
UNIVERSITY OF SOUTH FLORIDA
COLLEGE OF ENGINEERING
enVision
MAGAZINE

The Future of Healing
Researchers discover silicon carbide a promising technology

Growth of Algae Biofuel
How trash may one day fuel our cars and more

College of Engineering Welcomes USF Lakeland Program
Information Technology academic program likely to begin Fall semester in Tampa

Mechanical Engineering Capstone Project
Students collaborate with Chromalloy Castings

Computer Science in the Operating Room?
Professor and doctors collaborate on making minimally invasive surgery even less invasive