enVision MAGAZINE

IN THIS ISSUE

ENGINEERING a Better Health Care *Experience*

With health care operating pretty much as it did in the 1980's, what will it take to bring it to the 21st century?

Remember when you needed some cash, and you had to get to the bank before 3:00 that afternoon? The line would shuffle through the rope maze at glacial speeds. Waiting for you behind bars, or if your bank was modern, behind bullet-proof glass, would be the teller. A single manicured finger pushes you a twenty across the counter. Now is not a good time to ask her what your account balance is because you neglected to fill out a few of those silly little stubs.

None of us want to go back to those "good old days." The banking and financial services got their considerable acts together and engineered a comprehensive and standardized way of providing services to their customers.

How about trying to find a lost package shipment? Hours on the phone with the sender and receiver and no resolution as to where your tulip bulbs are. The logistics companies got their act together. And talk about taking it on the road, they were so successful the U.S. Postal Service had to grudgingly institute package tracking to stay in competition.

And when was the last time you showed up at the airport only to find your flight cancelled? Phone calls, text messages, email, all inform us of delays or cancellations. While some of the services that airlines provide to customers are admittedly still works in progress, just think about the time when travel arrangements were made by walking into a travel agency, sitting down and growing old gazing at the faded travel posters of Italy. Waiting for the agent to give you the seven-layer ticket printed in blood red. It came with a lecture from the agent on how the ticket was just like cash money, and if you lose it, 'you ain't going no where'.

Banks, financial services, shipping, airlines - they knew that their survival depended upon re-engineering their entire service sector to provide customers with the ability to buy, sell, trade, find, lose and find again whatever the customer wanted. Huge competing corporations decided upon standards for gathering and safeguarding financial information. And with a relatively few well-publicized exceptions, keeps that information safe. Airlines forgot, for a few shining moments, their cutthroat tendencies and now you too can book a flight at 2 a.m. in the morning with six open windows to six travel websites displaying the latest fares and flights to Timbuktu.

However, there is one industry that is not available at the click of a mouse. One industry where you still have to show up at the appointed time, present appropriate paperwork to the admitting lady, leaf through tattered old magazines, and practice shallow breathing to avoid the contagion of the unfortunate masses sharing the recycled air in the room. Welcome to health care of the 1980's.

The word "health care" today has many meanings: personal health care, government health care, managed health care. You want to instigate instant political polarization? Just say "health care" and step back quickly. And it turns out that the "system" that most people refer to as "health care delivery" is not a system at all, but an outmoded and non-standardized service sector that evolved 60 years ago when most physicians were solo practitioners.

So how do you bring the medical world into the 21st century? You would need the combined efforts of physicians and industrial engineers, and a host of other multi-disciplinary approaches from human resources management to information technology. Where do you find these folks? At USF, of course. And spearheading these efforts are two professors who, in another time and place, might have been on the opposite sides of the fence in the health care discussion.

José Zayas-Castro, PhD, is the department chair for Industrial & Management Systems Engineering. For almost 30 years Professor Zayas-Castro has taught engineering design processes, organizational change, systems integration, entrepreneurship and business process engineering. In the past decade he has specialized in the redesign and reengineering of the service sector, particularly in how health care is delivered in the United States.

*So how **do** you bring the medical world into the 21st century?*

Peter J. Fabri, MD, PhD, is a professor of surgery and a medical doctor. Dr. Fabri has specialized in surgical endocrinology and oncology and critical care for 40 years. At the tender age of 60, he went back to USF to get his engineering doctorate. His PhD advisor was José Zayas-Castro.

Both of these men are passionate about their shared belief that the health care system must be re-engineered to provide a patient-centered system of efficient and economic reforms like the banking, shipping and airline industries have done in the past 25 years.

"But wait," explains Dr. Fabri, "You can't re-engineer something that does not exist."

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Engineering A Better Health Care Experience—cont'd.

Professor Zayas-Castro adds: "And we don't call it health care delivery. We are speaking of health systems engineering. The delivery part - that comes in later."

Remember these gentlemen have spent two lifetimes using the precise language of engineering and medicine. We are the beneficiaries of 70 years of their experience, a far cry from learning about health care reform from your local talk radio host.

There are two main elements that need to be defined. The first element is the engineering approach that fixes the current sad state of health care systems and processes. The second element focuses on the management and finance of health care. The health care reform bill, named the Affordable Care Act, is concerned with how we are going to pay for health care, not how to *fix* health care. However, both Dr. Fabri and Prof. Zayas-Castro strongly believe that if you fix health care, the payment for those services will go down.

Dr. Peter Fabri

Dr. Fabri minces no words when describing the current state of affairs: "Health care is still a cottage industry. It is delivered exactly the same as it was 40 years ago. The delivery systems are based on the time when most physicians were general practitioners in solo offices. It has simply been expanded in size without any substantial change in how it is done." Sounds pretty radical, but most of us of a certain age will probably agree that a doctor's office visit today is not much different than one we had in the 1980's. The same magazines are there. "This is a $2 trillion industry where everybody still runs what you could call 'mom and pop' shops. No standardization of records, no inter-communicability, no exchange of information, no process standardization, no point-of-care tool to assist physicians in making decisions," Dr. Fabri adds with the conviction of one who has been there, done that, and bears the scars.

Professor Zayas-Castro adds the engineer's response: "We want to increase the quality of care provided to patients. We want it to be effective and efficient. This is not about engineers telling physicians what to do or what not to do –it is about how to design a better way to do it. Keep in mind that the patient is the very center of this system."

Many professional engineering and medical organizations have done extensive work on health systems engineering. Dr. Fabri cites the Institute of Medicine (IOM) and its 2001 report *Crossing the Quality Chasm* which stated that sweeping changes in the delivery system were needed. In 2005, the National Academy of Engineering (NAE) joined this project and stated that complete systems engineering was necessary to deliver safe, effective, timely, patient-centered, efficient, and equitable care. As Dr. Fabri ironically points out: "We put a man on the moon within 10 years of President Kennedy announcing plans to do so. From that point forward, people started working together to develop the systems to make it happen." It has been ten years since the IOM announced those six goals, and none of them have been broadly implemented. "These goals are all basically engineering concepts. It is not about intelligence, it is not about creativity, it is about just doing things in ways that work better," he adds.

Current funding programs do not directly address the problem, explains Professor Zayas-Castro. "The NSF has programs that fund research into better delivery systems, but these resources are too small. The NIH principally funds medical research related to diagnostics or treatment – not on the actual delivery system-, and the AHRQ is probably the only agency that partially focuses on improving aspects related to improving systems in the health care. The totality of resources dedicated to really improve the healthcare delivery system is marginal at best."

Why has a comprehensive plan for health care systems not been implemented? Dr. Fabri is blunt: "There is no driver. There is no reason for anybody to change. Hospitals have made money, individual physicians have made money, insurance companies have made money. There is not any one, overwhelming, powerful reason for people to change." Professor Zayas-Castro adds the underwhelming reason for this, "The extended supply chain of health care in the United States lacks the global competitive forces that are present in other sectors." No competition is an interesting concept for most Americans when it comes to their health. We can easily find another physician if we don't like the one we have, provided that the 'other' physician accepts your insurance and has the expertise one is looking for. But does the new doctor provide

Message From The Dean

Welcome to a fresh edition of Envision. In this issue, I want to focus on three pillars of excellence that are vitally important for our College to succeed. They are academic excellence, student success, and a vibrant research enterprise.

This issue is packed with many examples of student success, and the increasing research collaborations between the College of Engineering and the College of Medicine on projects such as health care delivery, doctor-patient interaction, and age-related hearing loss. Though these are the stories featured in this issue, be assured that there are many more such collaborations ongoing that you will likely read about in coming issues.

Dean John Wiencek

The Computer Science & Engineering Department is 30 years young this academic year. Unlike 1980, we now accept computers as a fundamental part of our everyday life. You will enjoy this historical recount of how the department was formed. By digging into the past, we learned a tremendous amount about those enlightened professors who saw the future and built the foundation for our Computer Science & Engineering department. The department is currently ranked as the best graduate program in Florida by the National Research Council. This outstanding accomplishment is built on the hard work of students and professors, both current and past.

We receive frequent comments from those of you who hire our graduates that they lack experience. As a result, we have initiated a very broad-based Experiential Learning Program that will ultimately require every student to participate in an internship, co-op opportunity, work study program, etc. Our Corporate Ambassador Program and community business partners are providing many opportunities for our students and the number is growing. As alumni, providing a student with a real-world work experience is one of the single most important ways that you can give back to the College.

Finally, I want to acknowledge the growing number of friends, businesses and alumni who are supporting our important work with financial contributions. Your gifts to the College through scholarships and discretionary funds are vital to all three pillars of excellence. From the depths of my heart and soul, I thank you!

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MISSION STATEMENT

The mission of the College of Engineering at the University of South Florida is to improve the quality of life in our community by providing a high quality education for our students and practicing professionals; by creating new knowledge and solving real world problems via innovative research; and by engaging in effective community service and outreach.

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USF UNIVERSITY OF SOUTH FLORIDA
COLLEGE OF ENGINEERING

services in any different format or method than the one we don't like? Not according to Dr. Fabri. "The average American physician resists something as simple as electronic medical records because he can't see why it would be individually beneficial to him." Dr. Fabri makes the analogy of Japanese cars to American cars. "Both countries had access to the same technology, the same marketing information," explains Dr. Fabri. The Japanese started making smaller, more efficient cars. But the U.S. automakers did not see any compelling reason to change their strategy. The result was massive infusion of federal money to stay alive. The automakers had an 'ah-ha' moment, and said, 'we gotta make better cars'. But it took 40 years and impending bankruptcy to get to that moment."

Professor Zayas-Castro interjects a moment of systems management hope at this point. "If the airlines can send you a message that your flight is delayed, why can't your doctor's office do that?" he asks. "Why do people get woken up four times a night in a hospital for medications when they could get them once and be allowed to sleep?" He uses another example all too familiar to those who work with computers. "In busy clinical environments or hospitals, you see workstations surrounded by papers, files, equipment cables and so on. It does not have to be like that. You need to consider ergonomically what the providers and patients need, and reduce their stress when using that workstation. Create a much more comfortable and pleasant environment. This happens in every office environment." He pauses, "But please don't look at my desk now." Zayas-Castro continues in the workstation re-engineering vein. "Maybe we don't need workstations," he muses, "maybe the staff can use mobile devices and eliminate the need for dedicated workstations to begin with. This is just a small example, but you can see where it leads."

How do you put these processes in place for the thousands of doctors, clinics, hospitals and testing laboratories across the country? The doctor responds: "There are two approaches: One from engineering and one from the health side. The engineering needs to be developed through the national organizations that fund engineering research. There needs to be a concerted program to fund and develop health systems engineering.

Prof. Zayas-Castro

On the health side there needs to be a drive from the leadership of physicians. They have a responsibility to their patients to make health care high quality," answers Dr. Fabri.

"We are working with several other universities and institutions like Purdue, North Carolina State and the University of Arkansas," says Zayas-Castro. "We also collaborate with Moffitt Cancer Center, Tampa General Hospital and Baycare Health System. It is not just a top-down or bottom-up change, but a high level of cooperation. We can't take it just one step or one approach at a time. That takes too long. We have developed educational programs for doctoral students. We have interdisciplinary links between the USF College of Engineering and the USF Health Sciences. We are working with the Tampa VA Hospital and the complex systems that soldiers have coming home from war. And we will continue to submit large-scale proposals to the NSF and others willing to entertain them."

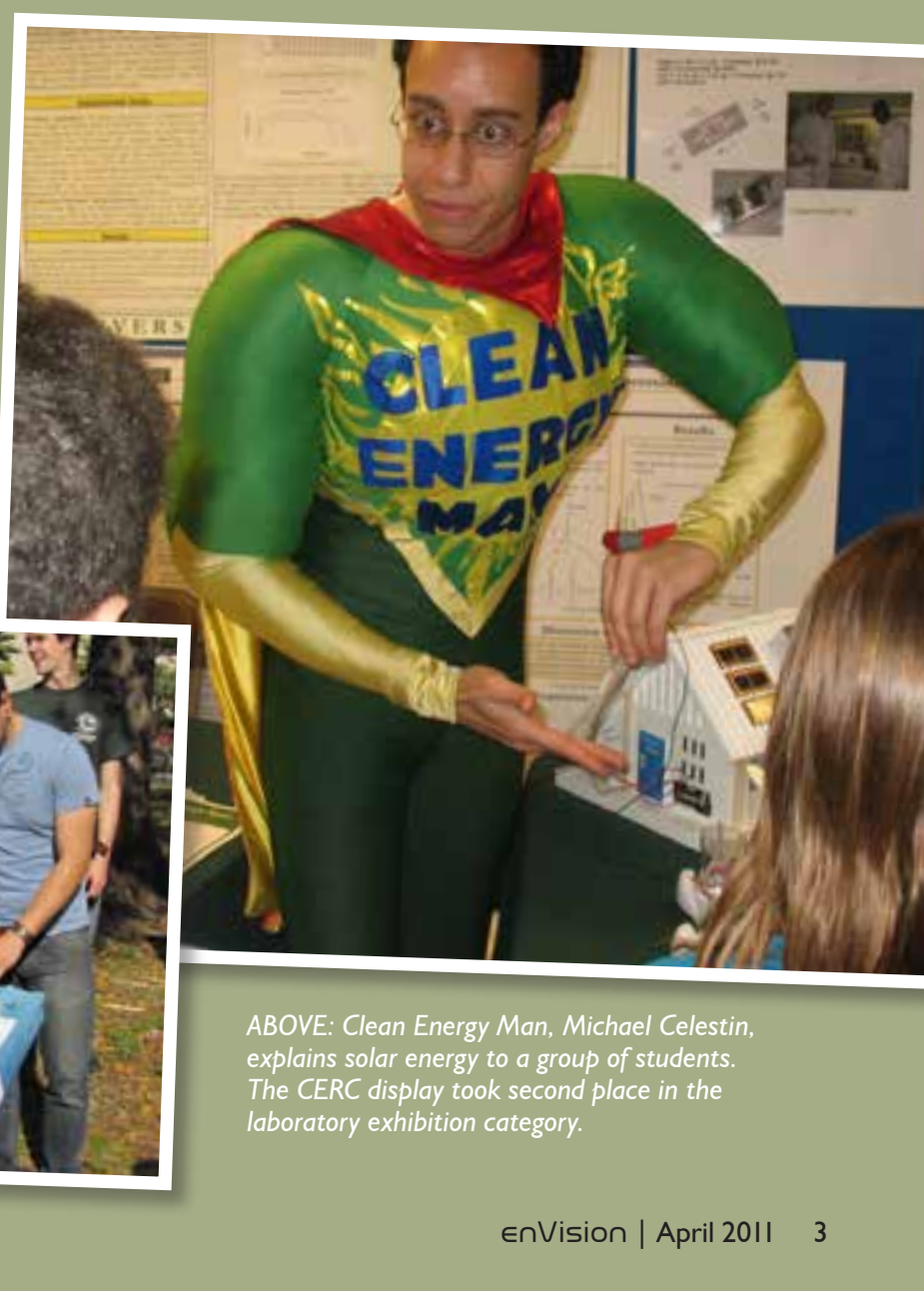
It is evident that Professor Zayas-Castro has his heart in his work when he talks about the most vulnerable members of our society, the elderly and the children. "We need to keep pushing the envelope," he says. "Our children, that's our future. They need a better health system than what we have. And we must keep in mind the unique needs of the elderly when we design these systems."

Professor Zayas-Castro has received numerous awards for his service to engineering education. He established the Learning Factory Program in Puerto Rico and received the Bernard M. Gordon Prize for Innovation in Engineering and Technology Education. He received the John L. Imhoff Award from the American Society of Engineering Education. He is the senior vice president of International Affairs in the Institute of Industrial Engineers.

When you finally get that text message that your doctor is running two hours late, you can thank the engineers and physicians like Jose Zayas-Castro and Peter Fabri who will make this possible.

39th Annual Engineering EXPO

On February 18 and 19, 18,000 middle and high school students from all over the state descended upon the College of Engineering for two days of hands-on science and engineering fun. The event has grown in popularity over the years, culminating in this year's largest attendance ever.

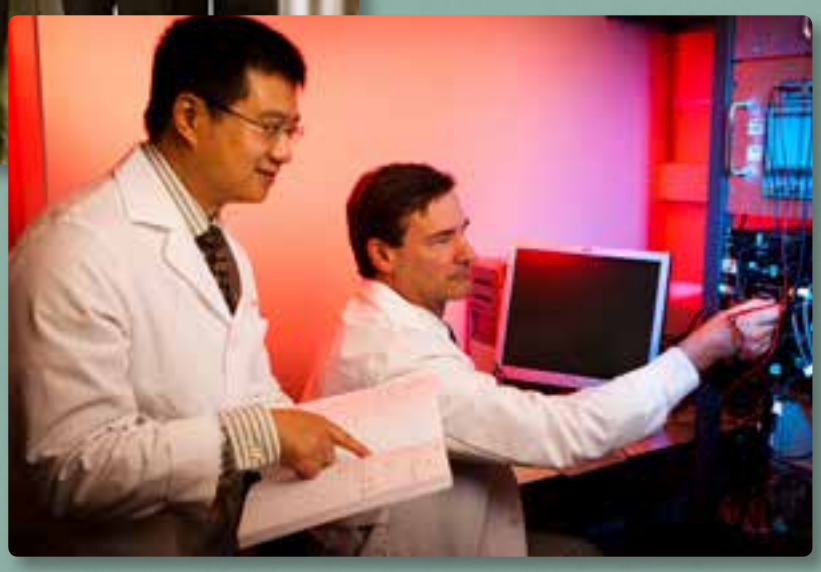


ABOVE: Clean Energy Man, Michael Celestin, explains solar energy to a group of students. The CERC display took second place in the laboratory exhibition category.

Of Middle Age MICE AND MEN

One of the most prestigious research institutes on hearing and speech perception has moved to the University of South Florida. For 27 years, the Global Center for Hearing & Speech Research has been pushing the envelope on age-related hearing loss research in Rochester, New York. The researchers have moved their middle-aged mice and microphones (but not their snow shovels) and will continue their work in new state-of-the-art laboratory facilities at Research Park on the USF campus.

The Center is a full-service research institution. The multi-disciplinary research scientists in the group do everything from developing specialized strains of mice to providing hearing services for humans. The group is funded by several grants, including a five-year Program Project from the National Institutes of Health titled "The Aging Auditory System: Presbycusis and Its Neural Basis." Spoiler Alert: yes, that does mean that it is in your brain and not your middle-ears, that hearing loss happens. And you thought it was one too many Grateful Dead concerts.



Left to right: Dr. Bo Ding, Dr. David Eddins, Dr. Xiaoxia Zhu, Todd St. John, Dr. Ann Eddins, Dr. Robert Frisina, Jr., Dr. Emily Plowman, Dr. Joseph Walton.

The Tampa area is an obvious choice to study hearing loss in aging populations. But it was the research reputations of the College of Engineering and the Department of Communicative Sciences & Disorders that determined the Center's new home. Principal Investigator Robert Frisina, Jr. explains: "USF was one of the few places that is expanding its biomedical engineering. We saw that as an opportunity for growth, and we want to be part of this expanding program." Another plus for Tampa was the location of two large Veteran's Hospitals. "Many of our service people are coming back from the wars with Post Traumatic Stress Disorder through these VA hospitals," explains Professor Frisina. "Part of PTSD is noise-induced hearing loss. One of our focuses is to understand the role hearing loss plays in this syndrome."

Professor Frisina is in the Department of Chemical & Biomedical Engineering and specializes in neuroscience and experimental psychology - and chief 'mouseologist'. Because matching your mouse population to their human counterparts is crucial. Your animal models must mimic the human condition as close as possible. The Center works with several strains of mice some of whom age quickly, some age slower. Some start to show hearing loss in the mouse version of middle age, which is precisely what the Center is studying. By interbreeding these strains, Professor Frisina has developed a mouse that hears exceptionally well into mouse-dotage. Understanding why these "golden ears" mice can still hear like a teenager and collect mouse Social Security at the same time could be crucial to understanding human age-related hearing loss.

Another landmark study by the Center involves hearing loss in aged women who had taken Hormone Replacement Therapy (HRT). Frisina duplicated that study using his ample supply of middle-aged female mice. The results indicated that mice who had been given a subcutaneous time release of estrogen and progesterone suffered hearing loss at up to 30% greater than the control mice, or the mice given just estrogen, the exact same result as the human study.

But exactly how do you tell if a mouse can hear? Like mice, human hearing consists of the inner ear detecting sound waves and sending that information to the brain where it is processed as music, speech or noise. This two-part process leads to one of the primary research areas of the Center. Frisina puts it simply: "Is the problem in the inner ear, or is the problem in parts of the brain used for hearing"?

The neuroscientist who brings you this bit of good news is Joseph Walton, PhD. He can be found in the Department of Communicative Sciences & Disorders (CSD), monitoring individual brain cells in his middle-aged mice using extremely small electrodes. "We insert these electrodes into a group of nerve cells (neurons) that process sound," explains Professor Walton. "If the neurons fire, especially at a particular tone, we can see and hear that on our equipment." He starts with simple tones and progresses to complex sounds that mimic actual mouse vocalizations, or the mouse version of human speech patterns. These experiments are performed on many different strains of mice at different age intervals. This sounds straightforward, but you have to bear in mind that the Center develops and utilizes technology right down to determining exactly what the tiny whisperings of mouse vocalizations are. "Our research is a translational model where physiology, molecular biology and human testing and human subjects are in the same location, and members of our research team from these different disciplines interact with each other on a day-to-day basis," explains Walton.

On the human side, David Eddins, PhD, takes much of the mouse research and applies it to very human situations. Also in the CSD department, Eddins is an audiologist and psychoacoustician, a person who studies the perception of sound. "One of our main goals is just to understand the processes underlying speech and hearing in general," says Eddins. "A lot of our work is basic science, how processes change when someone has hearing loss, age-related or otherwise. But a fair amount of what we do is investigating new treatments and devices." The Center is looking at revolutionizing the 50-year old technology currently in hearing devices. Instead of amplifying sound waves, they are looking at using a small laser light to stimulate various cells in the inner ear and in the brain. Using microcircuitry, they are looking at improving the current crop of hearing aids to help eliminate background noise, one of the biggest complaints of hearing aid users.

What? We could have turned up those earphones anyway. It's the old brain that is malfunctioning? Great! As Professor Frisina explains, it is not exactly the hearing that is failing. "As people age, they lose the ability to pick up important timing features of speech. As I speak to you, your brain is analyzing those sounds. It is distinguishing between different letters and consonants and emphasizing certain syllables. This is what changes with age, in your brain. One of the great characteristics of our research group is that when we look at problems like aging, we can distinguish if the problem is in the inner ear, or the parts of the brain used for hearing." The loss of this timing function is the brain's fault, and is best summarized by Frisina's encouraging words: "By middle age that system is significantly impaired in humans and mice." This probably explains the complaint of many Boomers who can no longer follow a conversation in a noisy restaurant. In the audiology world, it is a known fact that younger people can separate conversation and background noise with ease. If you are a restaurant owner or nightclub owner, you know this, and build your facilities that actually create noisy and bustling environments. And it keeps the old folks out. It is also known that most adults lose the ability to hear high frequencies, so ringtones for cell phones are available at frequencies only teenagers can hear. But don't bet against the aging Boomers, some businesses actually blast a high-frequency sound to prevent teenagers from loitering in the area. It keeps the young folks out.

David Eddins explains that one of the biggest advantages to the Center's work is that instead of studying the hearing issues of the elderly, they are concentrating instead on the middle-aged. "We see clear signs of aging in middle-aged humans and mice. More and more aging work is turning toward studying issues in middle age," he says hopefully. "With interventions we can begin to detect and reverse the negative aspects of aging and do things to slow down any progression."

Say, what? You mean it's not only my hearing, but also my brain? Cool. Now where's my Rolling Stones' CD. If I can just remember where I put it …

If you are interested in participating in a hearing loss study send an email to *hsr@usf.edu*.

Virtual Reality System
to IMPROVE the Doctor-Patient Experience

Scout Finch would have made a great doctor. Her father, the wise Atticus, used words that the six-year-old girl understood. He was describing empathy, the ability to be sensitive to another human being's feelings, thoughts or situation. To walk in someone else's shoes, as your own father might have told you. Truth is most of us have to work a bit at being truly empathetic.

But sometimes, you need professional empathy. When it's really important, who do you want climbing around in your skin? Your doctor. It's part of their job. They go to school for about 10 years, they take courses in this stuff, right?

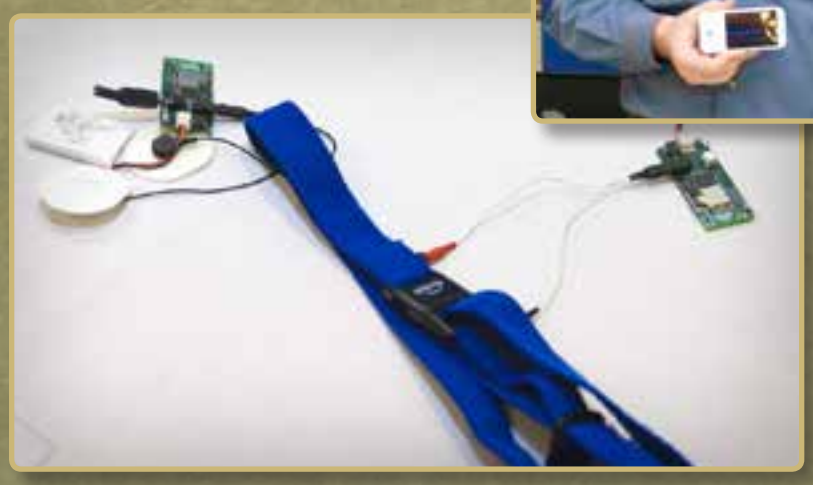
Unfortunately, empathy genes are not distributed evenly across humanity, and this includes medical students. And to be a good doctor, you must hone your empathy skills. So how do you do this? It takes a bit of Avatar, a dash of Star Trek's Holodeck, and yes, one of those cool head-mounted displays. Welcome to the world of virtual experiences for social perspective-taking.

Andrew Raij (pronounced rye), PhD, one of Electrical Engineering's newest assistant professors, was part of a team (led by Dr. Benjamin Lok, University of Florida) that developed a virtual reality (VR) system for conducting a medical interview between a human and a virtual patient. "It is like a flight simulator for doctors," explains Professor Raij. "In a simulator, you can crash 100 times learning how to fly an airplane, but there are no fatalities." Instead of training a pilot how to fly a fighter jet, the system trains medical students to conduct a good medical interview.

Practicing at being a good doctor is only the first part of the experience. For 10 minutes the medical student asks the virtual patient questions and responds to her answers. The second step is a medical examination on a mannequin that is instrumented with sensors that detect the student's touch. When the medical student is through with both interview and examination, the entire virtual experience is played back to the student.

Prof. Raij's innovation is in how the experience is played back. The student does not see the experience as a disinterested third party. Instead, he sees the interview and examination through the eyes of the virtual patient. The doctor becomes the patient. The student is prompted to say the patient's "lines" and listens to his earlier responses. He lies down on the table and gazes at the ceiling. He, or now she, can see if the "doctor" is looking directly at her/him, all the while listening to what was asked earlier. When he looks down at his own body, he sees her. When he looks at the doctor, he sees himself.

"Yes, it does get kind of trippy," laughs Raij. "But we built a system that allowed students to do two things that are not possible in the real world. One was to be able to practice interacting with a patient and to gain some comfort with that. The second was to do something definitely not available in the real world, which was to see themselves from the perspective of the patient. We wanted to see if we could encourage another person's empathy skills by viewing the experience through the eyes of another person."



mStress - Sensor Suite

Prof. Raij's project is unique because the point of view becomes that of the avatar patient. Other VR systems provide the user with an avatar that is unlike his or her persona. For example, a young person is given an elderly avatar to improve attitudes toward the elderly. But to truly see yourself in three dimensions through the eyes of another is pretty amazing. Am I looking at myself, or are my eyes wandering away? Am I answering my questions in a meaningful or educational manner, or tossing off a condescending answer? Raij's efforts specialized in the doctor-patient relationship, but the possibilities for virtual social perspective-taking (VSP) are endless. VSP could be used to review employment interviews, conflict-resolution scenarios, or any number of cultural or learning experiences.

As if this project wasn't interesting enough, Raij noticed something about the VSP project that had nothing to do with improving empathy skills. "I realized that in our system we were capturing a lot of sensor data about the human participants. We used 3-D head tracking, microphones, but all was in a laboratory setting. So it occurred to me, especially with what's going on in the wireless sensor world and our mobile phones, how great it would be if I captured information about my communication behavior as I talked to my wife, my kids, everyone. I could go back and figure out at a certain real-life encounter, that yes, I was really empathetic, nodding my head, smiling."

> "If you just learn a single trick, Scout, you'll get along a lot better with all kinds of folks. You never really understand a person until you consider things from his point of view...until you climb inside of his skin and walk around in it."
>
> -- Atticus Finch (*To Kill a Mockingbird*)

Undeterred by the fact that one could not put 3-D tracking cameras everywhere without issues, Raij turned his attention to wearable wireless sensor technology. Instead of tracking empathy in the laboratory, he decided to track stress in the real world. Medical experts agree that chronic low-level stress takes its toll on the cardiovascular system. Prof. Raij is working on VR and graphics tools for smartphones to help people reflect on and manage daily stress.

As a Post Doctoral Fellow (advisor: Dr. Santosh Kumar, University of Memphis), Prof. Raij and his team developed "mStress," software for Android smartphones that constantly collects information from small wireless sensors that are placed under the user's clothing. These sensors include ECG, GSR, galvanic skin response, respiration, 3-axis acceleration and body temperature measurements. "The sensors give you the ability to continuously capture information on stress," Raij explains. "In the past, recording stress has been momentary, like 'push a button if you are under stress.' Or maybe your phone buzzed once an hour and asked you how stressed you are." Now, the mStress physiological data stream is gathered by the smartphone and is pushed up to the healthcare provider's system or other applications on the phone with almost no effort on the part of the user. This straightforward and objective means of continuously measuring stress outside the lab has never been available until now and is critical to the creation of new applications for stress management.

Andrew Raij

"There's a lot of basic research to be done in taking this physiological data and transforming it to stress or not," explains Professor Raij. "A lot of work has been done in the lab. There are plenty of papers on what happens when we are exposed to stress in the lab, but the technology has not been available in the field, in the natural environment, until now."

Now at USF, Prof. Raij is looking for some help to take these ideas further. "I am definitely looking for collaborators and students," explains Professor Raij. "Virtual reality is powerful technology. We can go to places and times that we cannot in the real world. There is a lot of work to be done."

From making better doctors to managing stress, the benefits of VR and interactive graphics are limitless. If you are interested in this fascinating new world, contact Andrew Raij in the Electrical Engineering department at *raij@usf.edu*.

NUMERICAL METHODS

A Real-World Application on Open Courses

"Build it, and they will come." Autar Kaw, professor of mechanical engineering has not built a baseball diamond in his cornfield. Instead, he has plowed under the dried cornstalks of a traditional advanced mathematics course and created an open source Internet-based Numerical Methods class that receives hundreds of thousands of visits a year. The site is the model for the Computational Methods classes at the University of South Florida. It is also a comprehensive reference base for anyone looking for mathematical models used in situations where approximations are needed.

Professor Autar Kaw

The Holistic Numerical Methods Institute (*http://numericalmethods.eng.usf.edu*) uses every tool for teaching that the Internet provides, including downloadable textbooks, You Tube videos, worksheets, primers, class syllabi, PowerPoint presentations, online assessment, and even a blog. The user can select from among seven engineering major tracks (chemical, civil, computer, electrical, industrial, mechanical and general). Examples are provided in the math packages Maple, MathCAD, MATHEMATICA and MATLAB.

Professor Kaw is the author of four textbooks on numerical methods, matrix algebra, composite materials, and programming. But in 1990, he saw the future of education, and sent a proposal to National Science Foundation where he planned to send floppy disks to universities with textbook chapters and simulations on numerical methods without regard to copyright or payment. In 2000, the Massachusetts Institute of Technology (MIT) pioneered the concept of Open Courseware (OCW) on the Internet. Understanding that the Internet was the obvious vehicle for his concepts, he applied for and has received four National Science Foundation grants to create an open course on numerical methods based on the offerings at USF. Florida A&M, Old Dominion University, Arizona State University and the Milwaukee School of Engineering are also contributors to the website and use various modifications of the USF course in their engineering departments.

The course is not just a set of formulae arranged in a linear style. "The course uses real-world applications to teach engineering problems," explains Kaw. "Classes like algebra and calculus teach you problems that have exact solutions. But life is not like that in the real world you solve most problems approximately. That is what this course does. It solves a problem which can be modeled by mathematical models."

Since going live in 2001, the site has been awarded the ASME Curriculum Innovation Award (2004) and the ASEE DELOS Best Paper Award (2006). The site also publishes information on its own internal assessments of itself led by Ali Yalcin, PhD, associate professor in industrial and and management systems engineering. People who have contributed to the site are listed under the People link, giving credit to everyone from full professors to undergraduates and what each person contributed to the project.

To truly appreciate the originality and the incredible amount of work that has gone into it, you simply have to visit. The home page is an easy-to-read grid of modular topics that are laid out in order of how a typical Numerical Methods course would be, but the user can jump around, or as Prof. Kaw suggests, "Just try using it a la carte." There is a thorough explanation of the site for first-time visitors. Both a Google site search and a Resources page for advanced searching is available. Even if you have trouble with multiplication tables, you can search in the Anecdotes on, say, the History of Interpolation and find out that Charles Babbage, the grandfather of modern computing, tried inventing a system that would choose winning horse race numbers in an effort to raise a bit of extra money for his difference engine. And if that proves too entertaining, you can always bring yourself back to reality with the Multiple-Choice Tests option.

This Holistic Numerical Methods website is not just a free, online classroom or a great reference if you have mislaid your MATLAB program for discrete functions. It is a concrete example of Prof. Kaw's philosophy that education has drastically changed in the last decade. Lots of folks in academia talk about the revolution in education, but there are not a lot of real-world applications of that philosophy. But this site is one of them. "This is a hybrid mode of

> Thank you for posting your video lectures online. It is refreshing to see a professor so committed to the spread of knowledge, rather than trying to profit from it. Thank you very much.

student profiles

Dayna Lee Martinez-Torres

Dayna Lee Martinez-Torres

PhD Candidate, Department of Industrial and Management Systems

Why did you decide to pursue a PhD in Industrial Engineering?

Since I was little I've been attracted to math and science, and Industrial Engineering came as a natural decision. It offers a great combination of science and math with human interactions in service and manufacturing industries. Once I finished my undergraduate degree at the University of Puerto Rico-Mayaguez, I wanted to continue with my PhD at USF and continue my career in the academia direction.

What are your career and professional goals?

To become a professor where I can do research, teach and inspire others, especially young women and minority students.

Discuss your involvement with community outreach programs.

As an NSF STARS fellow, I help local elementary teachers improve their science curriculum which helps excite children about science. I spend eight hours a week at Maniscalco Elementary helping 5th grade teachers develop and perform science lab activities.

Describe the intellectual merit of your research and its broader impact.

Non-pharmaceutical interventions (NPI) will likely be the only mitigation strategy at the early stages of a pandemic influenza. NPI includes quarantine, school closure, work place closure and travel restrictions among others. We attempt to develop a dynamic non-pharmaceutical intervention strategy using a simulation-based model that can both reduce attack rates and societal cost of a pandemic. This research will ultimately produce a decision-aid tool for mitigating a critical societal problem by reducing societal woes and economic forfeitures.

Al-Aakhir Rogers

Al-Aakhir Rogers

PhD Candidate, Electrical Engineering

Why did you decide to pursue a PhD in Electrical Engineering?

Initially, I chose to pursue a PhD because I thought it would be a great accomplishment to achieve, especially given my background as a first-generation-in-college student. However, as I continued to pursue the degree a fire was ignited and I discovered that I enjoyed the process. I had dreams about my work and spent my spare time reading related material. I came to the conclusion that my PhD chose me.

education," explains Kaw. "A few years ago I saw a big disconnect between what we are teaching in class and what students are seeing out there. I very much like to keep in touch with my students, and I would ask them how many things you learned in class are you using." He laughs and continues, "Some say none! So I would ask what they do see out there in the real world." He tucked these examples away and now many of them are incorporated into the website, easily and freely available for anyone to use. "Another reason for the site is openness," he continues. "Isn't that the whole idea of higher education anyway? It is so easy now with the Internet. Just put it out there!"

This has been an amazing resource for me. I'm a better audio-visual learner than reading hundreds of lines of text from my textbook. The YouTube videos are just brilliant! Thanks again!

Prof. Kaw is especially proud of the overwhelmingly positive response to the Numerical Methods site. Literally one million page views were recorded in the last year. There were more than half-million views of the audiovisual lectures on YouTube (http://www.youtube.com/numericalmethodsguy). His separate blog, The Numerical Methods Guy (*http://autarkaw.wordpress.com*) is also popular and the entries are motivated by questions that students ask him in class. One of the blog responses puts it simply: "I wish I had a teacher like you."

New topics for the Numerical Methods site are scheduled for summer 2011, including Optimization and Partial Differential Equations. Educators interested in customizing the site will find contact information under the FAQ section. Statistical analysis of the course and its success is discussed in the Publications link on the site. A recent proposal written to National Science Foundation seeks to adapt and assess the courseware at additional institutions including Alabama A&M University, Prairie View A&M University, Florida International University, University of Nevada-Reno, University of Texas-Tyler, Louisiana Tech University and University of South Carolina (USC).

What are your career and professional goals?

I want to be involved in academia where I am mentoring and guiding students.

Discuss your involvement with community outreach programs.

I have been involved in youth mentoring for the past five years. What began with 10-20 kids has now grown to more than 40. Through my local church where I teach, my objective is to develop and reinforce spiritual discipline and academic excellence. Moreover, I regularly speak on topics relating to STEM at local middle and high schools throughout Hillsborough and Pinellas Counties.

Describe the intellectual merit of your PhD research and its broader impact.

I am looking at a next generation of accelerometer based structures with integrated diffractive optics that on one hand will enable ultra sensitive detections of very small high frequency pressure changes (pressure waves launched by boats and skiffs of interest) while on the other enable very accurate depth sensing (resolutions of cms at 5000m) to accurately track chemical plumes such as those that occurred as an a result of the BP oil spill in the Gulf of Mexico.

research

NEWS

CARRT, The Center for Assistive, Rehabilitation & Robotics Technologies has a new logo to emphasize their commitment to research, education and service. The group also opened a new rehabilitation lab located on Laurel Avenue on campus.

CARRT
Center for Assistive, Rehabilitation & Robotics Technologies
Research • Education • Service

AWARDS

Two Mechanical Engineering Professors Receive NSF CAREER Awards

Nathan Gallant

Nathan Gallant and **Craig Lusk**, both assistant professors, have each received the prestigious CAREER award from the National Science Foundation. Lusk received $400,000 for his research on "Design Integrity in Shape-Shifting Surfaces." Gallant received $500,000 distributed over a 5-year period for his research "Combinatorial Biomaterials for Enothelial Cell Mechanobiology." This brings the total number of engineering faculty awarded CAREER grants to 17.

Craig Lusk

Research Professor and Co Director of CARRT, **Redwan Alqasemi**, has been named one of the "7 to Spot" by *Inventors Digest* in the April 2011 issue. He is recognized as one of the nation's most innovative mechanical engineers and was nominated by his peers.

Assistant Professor (CEE) **Jing Wang**, PI and Assistant Professor (EE) and co-PI, **Gokhan Mumcu**, were awarded a $476,663 three-year National Science Foundation GOALI grant titled "Antenna-Coupled ALD-Enabled Metal-Insulator-Insulator-Metal Diodes for High Responsivity and High Resolution THz/Infrared Focal Plane Arrays."

Jing Wang, assistant professor (EE) and PI, **Ryan Toomey**, assistant professor (ChBME) and co-PI; **Hariharan Srikanth**, associate professor of physics and co-PI, recently received a $130,000 one-year research award from Draper Laboratory by participating in the University R&D (URAD) Program. In addition, $65,000 of matching grant was awarded by Florida High Tech Corridor to strengthen the impact of this program on regional economic and workforce development.

Assistant Professor (CSE) **Yu Sun** and Research Assistant Professor (EE) **Adam Anderson**, PI and Co-PI, respectively, have received a three-year $499,000 NSF grant to develop a cyber-physical system capable of displaying the in vivo surgical area directly onto patients' skin in real-time, high definition. This research has the potential to revolutionize laparoscopic surgery by giving surgeons virtually transparent skin. The system will display the inside of a patient on the skin through a 3D projector-array and a micro camera cluster, giving the appearance of "transparent skin" and enabling single incision surgery with the visual benefits of open cavity surgery.

USF's **National Center for Transit Research** recognized twenty-three organizations that made an extra effort to offer employees alternatives to driving alone during the period January 1, 2010 to October 15, 2010. The Tampa office of Tindale-Oliver's Tampa office used social media and other organizational tools to encourage workers to join the national "Dump the Pump Day" in June, which promotes public transportation. The firm also sponsored bike-to-work and telecommuting programs.

Transportation Research Board (TRB) of the National Academies presented the Fred Burggraf Award to **Yu Zhang**, assistant professor (CE) and **Nagesh Nayak**, research assistant and civil engineering doctoral student in recognition of excellence in transportation research by researchers 35 years of age or younger.

Assistant Professor (ME) **Kyle Reed** received a grant from the National Institutes of Health for his project, "Gait Enhancing Mobil Shoe for Rehabilitation."

Computer Science & Engineering Department TURNS 30

This is the story of how visionaries within the College of Engineering created a world-class computer science department and research enterprise with no money, no space, no computers and too many students.

The Department of Computer Science & Engineering is 30 years old this academic year. There are state-of-the art classrooms and laboratories, cutting edge computer equipment and outstanding faculty teaching everything from artificial intelligence to virtual reality. Well-funded research into computer vision, robotics and advances in social networking has attracted the best and brightest. At USF, students are offered an incredible array of opportunities and cutting-edge research that will take them well into the next paradigm shift in computer science. The graduate program is ranked as the best in Florida and in the top third in the nation in research productivity by the National Research Council.

But, how did the Computer Age get started at USF? Who were those visionaries that saw computers were not just a passing fad, but the beginning of a revolution that would change the world – forever?

In the early 1970's, USF was fortunate to have a handful of engineering faculty who understood that computers were about to shake the very foundations of science, engineering and mathematics. Under the first Dean of the College of Engineering, Edgar Kopp, only a handful of computer science courses were being taught. Founding Chair of Industrial Engineering, Robert Wimmert, taught some introductory courses that were quite popular. Founding Chair of Electrical Engineering, Merle Donaldson, recognized early on the importance of computers and the need to start a curriculum dedicated to computer science.

But there were no computer science degrees at USF. In the early 70's, major universities were unsure where to place computer science programs, but the USF engineers knew from the beginning that this new discipline belonged to them.

At the same time, the Tampa area witnessed a huge growth in companies such as Honeywell, IBM and Univac. When electrical engineering professor Oscar Garcia arrived at USF in 1970 with a National Science Foundation Research Initiation grant on coding, he saw the significant industrial work on computers being conducted in the area. "The local Section of IEEE (Institute of Electrical and Electronics Engineers) did not even have a computer society chapter. So, I started one," explains Garcia, "and that brought our subsequent work at USF within the national scope of the IEEE Computer Society." He also remembers the PDP-8 computer that had to be booted by paper tape. "I remember programming it in machine language," Garcia recalls fondly. "It was clumsy, but it worked."

Merle Donaldson knew from his earlier experiences as Director of Research at ECI and his work at Sperry that the field of computer science and computer engineering were about to explode onto the scene. Therefore, from the very beginning of his period as chair he scheduled courses specifically about computer design and programming.

Harvey Glass, professor of computer science and engineering, and previous Honeywell manager, explains the mentality of the times: "In the 70's, several departments within the University claimed title to the term computer science, especially mathematics," recalls Professor Glass. "On the other hand, many faculty here at USF felt it should be a discipline without a specific home." At USF, many people were using computer applications to solve problems in their own specific fields. Departments ranging from music to mathematics claimed to be the experts in computers because they were used for creating databases of musical compositions or for solving problems using numerical methods. "Our small group was interested not in applications, but with studying computers and computing," says Glass. "But most campus users did not see a need to house computer science in any one single college or department. After all, anyone could use a computer."

In the meantime, events at another Florida school had an impact on the College of Engineering at USF. The elite Engineering Science program at Florida State University was being phased out. FSU's Engineering program had expressed a desire to move to USF, but another school, the University of Florida was also making a strong bid for the program. With a sense of urgency, Dean Kopp took Glenn Burdick, an electrical engineering professor, with him to Tallahassee to evaluate how the move should be made. They returned from FSU with a handful of faculty and students, including some very talented PhD candidates. In one fell swoop, they secured some of the talent and experience that would be important during the evolution of the new program.

Now, Dean Kopp needed to find a permanent home for the fledgling curriculum. He assembled a committee of considerable scientific depth, including faculty, researchers and academics. Oscar Garcia, George Zobrist and Vijay Jain in Electrical, and Harvey Glass and Louis Doty of Industrial were committee members who brought considerable technological experience to bear on the project. Harvey Glass and Oscar Garcia did the heavy lifting, politically and academically, to get the program settled and operational within electrical engineering.

In 1972 the first computer science and engineering program began at USF with Garcia and Glass as the first professors with 12 students enrolled in this sub-department within electrical engineering.

The debate on the rightful home of computer science continued across campuses and professional societies. Harvey Glass puts it in no uncertain terms: "Those of us on this committee were adamant that it should be a program offered within the engineering school. The curriculum that we inherited from Florida State had zero support, financial or otherwise." Mathematics was making a strong bid for the program, but national events and support from IEEE were tipping the scales toward engineering. "Mathematics did not relinquish its bid for ownership," Professor Glass says bluntly, "we stole it. We also circumvented the system. It was useful to us to inherit this program, because starting a new curriculum is difficult. When a new program is proposed, it must be given resources, space, equipment, faculty and funds. A new program competes with the status quo. We loaded our program with many existing engineering courses. We were basically stepping on a minefield."

Oscar Garcia was appointed assistant chairman of electrical engineering in charge of the fledgling department in 1974. His connections with the local computer industry shagged a donated PDP-11 from the Tampa Division of Honeywell.

From 1972 to 1979, computer science matured and the enrollment in the "sub-department" within electrical engineering grew to alarming proportions, devouring the courses designed by Oscar Garcia and Harvey Glass.

In 1980, the beleaguered electrical chair Donaldson conceded over a famous lunch to Garcia and Glass that this 'Computer Science is eating our bread and butter'! Burdick, who became the second dean of the College in 1979 after Kopp's death, was a strong supporter of computer science and engineering. He approved Oscar Garcia's request to create a fully independent department. While departments across campus were still making bids for computer science, Dean Burdick took the bull (so to speak) by the horns. "I just started the program and waited for someone to stop me, but no one ever did," he recalls. "But I suspect that the early 'snorting' by Garcia and Glass paved the way."

Computer science officially separated from electrical engineering in 1980 with Oscar Garcia as the first chair. Dean Burdick was forced to house the expanding department on the sixth floor of the USF Library. The space consisted of small windowless offices. Professors Nancy McDonald, Son Pham, Kane H. Kim, and Murali Varanasi were hired, along with Lynn Federspiel, the first departmental assistant.

The newly-minted program boasted 370 students in 1980. The impoverished department received several significant grants that year. Also in 1980, Oscar Garcia delivered an NSF grant of $250,000 which had to be matched by USF. While this practically broke the matching reserves of the University, it gave serious and undisputed credibility to the program. This considerable sum helped start a color graphics lab utilizing Apple computers. In 1981 USF got $500,000 from the Florida Legislature to improve curriculum and add professors, as well as an additional $400,000 to hire architects to design a new engineering building.

In April 1984, ten major Tampa Bay area companies (Paradyne Corp., Florida Power, Square D, Aircraft Porous Media, Honeywell, TECO, Citicorp, IBM, Hugo Schmidt Co and Tampa Cable Television Trust) combined forces to create a chair in computer science and engineering that would attract an eminent computer science professor. The companies agreed to contribute a combined $600,000 with the Florida Eminent Scholars Act providing the remaining $400,000.

Professor Rafael Perez, hired in 1983, remembers the old library offices fondly: "There were no windows, and the library was closed on Sundays. We had to enter through the loading dock and take the service elevator. On the other hand, the library was a convenient location for reference books. We never had to check them out."

"FORTRAN was required for all engineering students in 1983. "There were 300 students in this course, which used punched cards," recalls Perez. "They would take their cards to the IBM mainframe in the student services building. An operator there would take the cards and run the program. The students would return several hours later or even the next day. Printouts were placed in bins arranged alphabetically with the student's last name. When the printout was only a couple of pages, the students knew that the program had not run because of some syntax error. They would have to resubmit the entire deck again. The lines of desperate students would get very long when programming assignments were due. We did not get an online editor until 1985."

An indefatigable fund raiser, Dean Burdick requested funding from the Legislature for a mainframe computer. Three Prime computers were acquired. He is proud to say that USF has the distinction of being the first university in Florida to have its own mainframe within the College.

In 1987, the computer science and engineering department moved into its permanent home in the brand-new Engineering II building. The project had been spearheaded by Dean Burdick, and the new home was awash in sunlight streaming through the windows and students hustling through the corridors. As Professor Perez recalls, "We had felt like we were not part of the College of Engineering. We were thrilled when Engineering II was finished and we moved into our offices, and we even had research and teaching labs."

Larry Hall, professor and current chair, joined the department in 1986 and recalls that back then the University had a "no computers on desktops" policy. "As a grad student at another university, I had a workstation on my desk," recalls Hall. "I can't give you a good reason for this policy, except that perhaps they could not do it for all faculty at the time." Eight-inch floppy disks were considered high-tech at the time, and BITnet connected the computers. "A research identity was just beginning to emerge in the later 80's and a strong national ranking was a dream," states Professor Hall.

Distinguished University Professor Nagarajan Ranganathan joined the department in 1988. "The VAX 11/730 had to be accessed by a teletype terminal from our offices," he recalls. "I was used to having a SUN workstation in my office before joining USF and even as a student before that. It was a huge cultural change." Ranganathan secured an NSF grant that went toward these workstations. He recalls with a touch of pride: "We finally had enough equipment, and we started looking good."

Murali Varanasi was the department's Graduate Program Coordinator in the early days. He recalls the library's food and drink prohibition. "You had to sneak your lunch into the building in your briefcase," he recalls. If the librarian caught wind of it you would get quite a scolding. Little did Varanasi know when he was eating all those sandwiches on the sly, that someday he would be the Chair of the Computer Science & Engineering Department.

In 1984, ABET accredited the Computer Engineering program, and in 1988 Computer Science received accreditation by the Computing Accreditation Commission of ABET. For a department formally organized in 1980, this is a remarkable achievement, and an enduring testament to the curriculum designed by Oscar Garcia and Harvey Glass. "This excellence and current ranking is due to the contributions of many well-intentioned people," explains Oscar Garcia modestly. "They not only cared selflessly about the advancing technology, but also about their students and professional colleagues."

Where are they now?

Harvey Glass is an emeritus professor of computer science at USF. Oscar Garcia enjoyed creating computer science departments so much that he became the founding Dean of the College of Engineering at the University of North Texas, where he is still a professor of electrical engineering.

Like many noble human endeavors, Computer Science & Engineering at USF is the product of a handful of dedicated visionaries. Now, almost forty years ago, their vision and dedication produced a world-class educational opportunity for today's students, and tomorrow's visionaries.

In 1980, the new Computer Science & Engineering Department awarded just three undergraduate degrees in computer science. Two of the first PhD graduates would go far. Shin Heu, the first student to receive a PhD within the newly formed CS&E department graduated in 1986. Heu is now a computer science professor teaching operating systems at Hanyang University in Seoul. David C. Davis was Chief Engineer at Honeywell when he received the first doctorate in computer science and engineering when it was a sub dept. As Oscar Garcia points out, "Honeywell was extremely helpful to our Computer Science program, and a good corporate citizen."

Today the department has 288 undergraduate students, 50 master's students and 63 students in the doctoral program. Many students are now movers and shakers of industry and respected professors at leading universities. (See photo top right).

Photo (left to right)

Chandra Kambhamettu, Dmitry Goldgof (USF), Wen-Chen Huang, Kevin Bowyer, Maha Sallam, Senthil Kumar, Kevin Woods, Sudeep Sarkar (USF), unidentified student. c. 1989

Success Measured by Graduates

Professor and Associate Chair **Dmitry Goldgof** joined the department in 1989 and marvels at the changes the department has experienced since then. "I measure the success of the department by its students," he says. "I believe our current students will be even more successful. I look at this old photo and I feel very proud of the amazing success of the department's graduates. Some went to work in universities, others in industry. I believe our current students will be even more successful."

Chandra Kambhamettu has worked at NASA-Goddard and is now a professor at the University of Delaware. He is well known in image processing and medical imaging community with active research program with funding from NSF, NIH and DOD.

Wen-Chen Huang is professor and past department chair at the National Kaohsiung First University of Science and Technology in Taiwan. **Senthil Kumar** is an established researcher at Bell Labs with numerous patents and publications.

Maha Sallam together with **Kevin Woods** started ISSI, the first company in the United States with an approved digital mammography screening device. It was later acquired by ICAD where Maha became a vice president. Currently, she is leading another medical imaging start-up VuEssense, Inc., in Tampa.

Other notable graduates include - **Kishore Bopardikar**, founder and president of Calypso Technologies; **Randy Burdick**, EVP and CIO of Office Max.

The Cost of Computing Now and Then

Computer Science & Engineering Chair Larry Hall admits to having a TRS-80. "It had a cassette for external storage," he laughs, "but the computer in my cell phone is more powerful."

"In the 80's, it cost about a thousand dollars for one megabyte of hard disk drive storage," recalls Hall. If you used that standard today, a mid-range PC with 500 gigabytes of storage would cost $512,000, or over half a million dollars. "Today, one terabyte can be had for about $80 as an external drive," he explains. "Our department uses an ever-growing 57 terabytes of disk space today – and we thought 10 megabytes was a luxury."

One terabyte is 1,024 gigabytes. And if you had ten of these external drives, you could hold the entire Library of Congress.

"For storage in 1986 we had eight-inch floppies and spooled tapes," Professor Hall says. In those days, a double-sided, double-density floppy disk would hold less than a megabyte." Reel-to-reel magnetic tape was also used, and the massive cabinets storing these reels could take up enormous amounts of space. A favorite backdrop for 50's and 60's sci-fi movies, the reels were replaced in the mid 80's with enclosed cartridge tapes.

When Computer Science & Engineering became a department in 1980, 64 kilobytes of memory cost about $400. Today, 4 gigabytes of memory will run you about $100. In other words, sixty-five thousand times as much memory for a quarter of the original cost.

CAMILLA COLETTI: FROM USF STUDENT TO WORKING ALONGSIDE NOBEL PRIZE WINNERS

Interdisciplinary approaches and international connections are part of the world-class education available at the University of South Florida. When professors like Stephen Saddow in the Department of Electrical Engineering are committed to attracting international scholars, anything is possible. Sometimes these scholars can change the course of research and take their USF education to the most prestigious research institutions on the planet. Camilla Coletti, a student from Italy, has had a dramatic impact on biomedical research at USF. Her USF education has enabled her to work alongside Nobel Prize winners at one of the world's most prestigious research institutions. To appreciate Camilla's experience at USF, we have to travel back to one of the world's oldest universities, post-war Germany and the latest Nobel Prize winners.

In 1355, Charles IV, King of Bohemia and Holy Roman Emperor, granted the Italian city of Perugia the right to have a university. An educated and enlightened ruler, Charles IV chartered a university in Perugia "for all people, even those from remote places." From its inception, the University of Perugia was actively engaged with other academic institutions and scholars from outside the city's famous walls. Here in the 19th century, the old speculative sciences gave way to the experimental and the modern techniques of research. In the 21st century, Camilla Coletti, a young woman from the nearby village of Marsciano, starts her engineering education.

Exactly 100 years ago in Germany, the Kaiser Wilhelm Society was founded. At the end of WWII, the Society was in disarray, with many of its members either sequestered away by Allied countries or under indictment for war crimes. In the early years of the Cold War, the occupying U.S. Army threatened to dissolve the Society. In 1948, the Society was reorganized as the Max Planck Society, named after the German founder of quantum theory and one of its directors.

That Cold War was just about over in 1988. As a result, that same U.S. Army was consolidating its many disparate military research entities (like the group that developed ENIAC), into one centralized laboratory in Maryland. Here, a young engineer, Stephen Saddow, began his research in silicon carbide.

In 2004 two former Russian scientists stop levitating frogs and start sticking scotch tape to a chunk of graphite. Andre Geim, and his former student Konstantin Novoselov, literally use adhesive tape to peel off sheets of carbon from their graphite. Their work at the University of Manchester would later be rewarded with the 2010 Nobel Prize for "for groundbreaking experiments regarding the two-dimensional material graphene." Dissatisfied with the research and political climate in Russia, they had come to England by way of the Netherlands, to continue their research.

In 2004, Dr. Saddow was a Visiting Professor at the Max Planck Institute for Solid State Research in Stuttgart, Germany. His research into silicon carbide leads to designing and building a hydrogen reactor based on his experience with chemical vapor deposition (CVD). While at Max Planck, Saddow puts out the word with several international colleagues that he would be interested in hosting students to come to USF's Department of Electrical Engineering for a visit and to consider USF for their doctoral studies.

In 2004, Camilla Coletti is awarded her bachelor's degree from the University of Perugia. Through her professor from the University of Perugia she accepts Saddow's offer. For the next three years at USF she investigates the biological interface between silicon carbide (SiC) and various living cells in-vitro. At the time, there was controversy over the cytotoxic nature of silicon carbide, so at Prof. Saddow's encouragement and under the direction of Dr. Mark Jaroszeski (USF BME Department), she systematically began working with silicon carbide surface science and biocompatibility for her PhD dissertation. Her work on silicon carbide at USF will help open up a whole new world of devices, implants, sensors and bone replacements that the human body will not reject.

THE COLLEGE OF ENGINEERING CORPORATE AMBASSADOR PROGRAM

The College of Engineering Corporate Ambassador Program (CAP) has been busy this year re-launching their program, recruiting new members, assisting in college activities and discovering ways alumni can give back.

Paul Stevenson, Vice President of McCormick Stevenson and the current CAP coordinator, along with other members of the organization, has been focusing his efforts on partnering with alumni at local companies to hire current engineering students for internships, job shadowing and other experiential learning opportunities.

"When interfacing with a student in a professional atmosphere you are giving them the opportunity to gain real world experience as well as reinforce everything they learn in a classroom," explains Stevenson.

As the owner of a small company he says, "It is not only important for a student to know how to do the job, but to be able to socialize with co-workers while having real world experience before graduating."

Like nearly every other local government in the United States, Hillsborough County's budget is stretched thin. The Hillsborough County Public Utilities Department (PUD) is no different, with the need to reduce costs wherever and whenever possible. CAP member and Senior Utilities Project Manager at PUD, Dr. Gita Iranipour says, "Cutting costs and maximizing resources without sacrificing quality, safety, reliability, and service requires new strategies."

The PUD has initiated an internship for credit program through the Engineering Alumni Society, which has proven to be a win-win arrangement for both the PUD and the 11 current interns they hired through the college. "The engineering students are able to develop job skills and expertise before the graduate, and also receive reference letters to use as they pursue their studies or professional careers," illustrates Iranipour.

"As an alumna, I believe this program will make it possible for the students to gain a quality, out-of-the classroom educational experience and strengthen Hillsborough County by reinforcing community connections and creating new opportunities for collaboration and innovation."

The program has already seen great success and CAP hopes to see it grow over the years and create many opportunities for students to work with local engineering alumni. If you or your company would like to be involved please contact Paul Stevenson, (727) 735-9633, *paul.stevenson@mccst.com* or Bernard Batson, Director of Diversity and Outreach Programs, *bbatson@usf.edu*.

But something else happened along the way.

While using the CVD reactor at USF, Camilla observed carbon-rich surfaces were being created when working with silicon carbide films. This was a very interesting detour from the biocompatibility studies, and along with Prof. Saddow she presented a paper at the 2006 Materials Research Society meeting in San Francisco. Many of the meeting attendees were astonished to see that the research being done at USF might actually be producing graphene.

Graphene has always been around in nature, but only through recent developments in surface science has its existence been proven. In fact, the use of an ordinary graphite pencil creates billions of tiny sheets of graphene. It would take three million sheets of graphene to measure one millimeter of thickness. Astonishingly, this single layer can be made visible under a high-powered electron microscope. A single two-dimensional sheet resembles a honeycomb, or chicken wire, structure which is a hexagonal lattice of incredible strength that is more than two hundred times the strength of steel. Electrons move through this sheet faster than any known material. Like its cousin, the diamond, graphene is made from the humble carbon atom.

Camilla stands atop a synchrotron that measures graphene in Lund, Sweden.

"The scotch tape method that Andre Geim and Konstantin Novoselov used is called **mechanical exfoliation**," explains Saddow. "They were able to harvest the graphene from repeated applications of the adhesive tape. A second technique is to take silicon carbide crystals and heat them up so that the first layer of silicon evaporates off the crystal, leaving behind the carbon layer. With this method **epitaxial graphene** is obtained. In epitaxial graphene, the organization of the carbon atoms is aligned to a substrate, in this case silicon carbide. It was this epitaxial method that Camilla Coletti independently discovered in her biocompatibility work at USF."

So Camilla's paper was presented to the MRS in 2006, and Prof. Saddow's group kept their eye on the prize: biomedical devices utilizing silicon carbide. "Using silicon carbide is huge," emphasizes Saddow, "because most materials now used for body replacements are toxic. For example, titanium hip replacements. The titanium has to be coated with an oxide to prevent the titanium from poisoning the body. If we can replace a lot of these metals with carbon-based materials, we will be in great shape." And proving that silicon carbide is biocompatible with certain body tissues is precisely what Camilla Coletti had done at USF.

After she received her PhD from USF in 2007, Camilla was awarded the prestigious Humboldt Fellowship from the German government to continue her research back at Max Planck Institute. "There, Camilla pioneered a very important aspect of graphene," explains Saddow. The Holy Grail at the time for graphene was a free-floating layer without any bonds to a substrate or to another graphene layer. "When you grow graphene epitaxially" continues Saddow "the first layer of carbon that is formed on top of silicon carbide is not free standing graphene, because there are covalent bonds to the substrate. But what Camilla discovered is that by using hydrogen intercalation, she could break those bonds to the substrate and achieve a fully free standing floating graphene layer." And the machine that she used in her research? "She used the same hydrogen reactor at Max Planck Institute in Stuttgart that I helped to build when I was there in 2004," says Saddow proudly.

Now, Camilla Coletti produces the graphene at Max Planck that is used for further research back at USF. "Without Camilla, none of this would have happened," explains Saddow. "She really was the pioneer in the group. Now we are developing silicon carbide materials for biomedical devices. We are moving toward devices, biomedical implants and carbon-based electrodes. We can do implants, sensors, therapeutics, diagnostics, and now we are incorporating graphene as a non-metallic conductor for these advanced devices."

So a young student from an old school accepts an invitation to study abroad and finds herself working with the same material as the future Nobel Prize winners which changes the direction of her biomedical research that qualifies her to join a prestigious research institution that her advisor's former employer tried to shut down. Camilla's international story is just one of many that you will find at USF's College of Engineering where the ancient philosophy of education for those "even from remote places" is still alive today.

alumni&students

ALUMNI NEWS

Laura E. Barnes joined USF Health in the Division of Evidence-Based Medicine in May 2010 as an assistant professor. She received her MS and PhD in computer science and engineering from USF in 2007 and 2008, respectively. Her primary research interests include decision support systems, medical informatics, and intelligent systems.

The Engineering Alumni Society awarded 30 conference grants for travel and presentations around the world. Each student received $250, with a total contribution of $7,500. The funds provided were generated through various EAS fundraising initiatives.

CONGRATULATIONS TO THE FOLLOWING COLLEGE OF ENGINEERING PHD GRADUATES ON THEIR RECENT FACULTY APPOINTMENTS:

Shyam Aravamudhan, assistant professor, Joint School of Nanoscience and Nanoengineering, at North Carolina A&T State University in Greensboro, NC.

Deidra Hodges, assistant professor, Department of Electrical Engineering, Division of Engineering, at Southern Polytechnic State University in Marietta, GA.

Jonathan Mbah, assistant professor, Department of Chemical Engineering, at Tuskegee University in Tuskegee, AL.

William Mondy, associate professor, Tissue Engineering & Biofabrication, at Claflin University in Orangeburg, SC. He also has adjunct appointments with the Medical University of South Carolina and the University of South Carolina.

Vishnu Nanduri, assistant professor, Department of Industrial and Manufacturing Technology, at the University of Wisconsin-Milwaukee.

Wilkistar Otieno, assistant professor, Department of Industrial and Manufacturing Technology, at the University of Wisconsin-Milwaukee.

Daniel Otero, assistant professor, Department of Engineering Systems at Florida Institute of Technology in Melbourne, FL

STUDENT NEWS

Seven engineering students won awards during the student technical poster competition at the 22nd Annual HENAAC-Great Minds in STEM conference in October sponsored by NASA. Winners are: **Sheila Jean**, Electrical Engineering; **Ivonne Rodriguez**, Chemical Engineering; **Mauricio Rojas**, Chemical Engineering; **Al-Aakhir Rogers**, Electrical Engineering; **David Cure**, Electrical Engineering; **Dayna Martinez-Torres**, Industrial and Management Systems Engineering; **Alexandra Oliveros Villalba**, Electrical Engineering.

Mechanical Engineering doctoral student **Onursal Onen** received Best Student Paper award at the Florida Chapter of the Acoustical Society of America meeting in October. Onen working with Assistant Professor **Rasim Guldiken** submitted his paper titled "A MEMS Ultrasonic Sensor Design for Early Ovarian Cancer Detection."

Civil Engineering doctoral student **Mersedeh Akhoondan** is a winner in the USF's third annual Research Excellence Award based on her presentation titled "Cathodic Behavior of ~9% Cr Steel Reinforcement in Concrete" at the USF Graduate Student Research Symposium.

The College conferred 312 degrees in December. 184 BS 113 MS 15 PhD

OUTSTANDING GRADUATING SENIORS FALL 2010

Chemical & Biomedical Engineering
Tam Nguyen

Civil & Environmental Engineering
Emily Carol Engstrom

Computer Science & Engineering
Donald Ray

Electrical Engineering
Jeremy Fertic

Industrial & Management Systems Engineering **Richard Vassallo**

Mechanical Engineering
Brittany Hudson

Chemical Engineering major, **Hannah Feig**, won a $5,000 Gilman Scholarship to study abroad in Senegal for a semester. The program is sponsored by the U.S. Department of State Bureau of Educational and Cultural Affairs and administered by the Institute of International Education (IIE).

Career Cast released its 2011 Jobs Rated results and **software engineer** tops the list as having the best outlook for hiring with a typical income of $87,400. 2011 Jobs Rated report examines 200 jobs to help look beyond hype and uncover the facts about different professions. Also ranking in the top ten at No. 5 is computer systems analyst.

The Computer Science and Engineering Department graduates' education is closely aligned with software engineer.

Civil engineering graduate student and CUTR student **Menna Yassin** is the recipient of TBITE's Keith Crawford Student Scholarship.

Electrical engineering student **Kevin Kellogg** and mechanical engineering student **Peter Falvo**, participants in the NSF-funded Research Experiences for Undergraduates (REU) program received Second Place in the Student-Built Vacuum Systems Design Poster Competition during the American Vacuum Society's (AVS) 57th International Symposium and Exhibition in Albuquerque.

Five undergraduate students received awards during the student technical oral and poster competitions at the 18th NSF Florida-Georgia Louis Stokes Alliance for Minority Participation (FGLSAMP) Research & Career Expo in Jacksonville, FL, held February.

Ivonne Rodriguez, (ChBME) placed first within the Chemistry category for her oral presentation, "Cooper-Catalyzed Cross Coupling Reactions of Amidines as Post-Stroke Therapeutics."

Hayde Silva, (EE) placed first in the Engineering category for her poster presentation, "Variation in Microneedle Geometry to Increase Shear Strength."

Yohannes Samuel, (EE), placed first within the Engineering category for his oral presentation, "Measurements for Omni-directional verse Directional Antennas in a Compact Reconfigurable Channel Emulator."

Carolina Lopez (CHBME)) placed second in engineering poster. REU Mentors: **Venkat Bhethanabotla** and **John Kuhn** (Chemical and Biomedical Engineering), *Synthesis of Ag-Cu Bimetallic Nanoparticles* Poster – Computer Science.

Dashawn Matias (CSE) and **Demetrius Richardson** (CSE) placed third in computer science poster. REU Mentor: **Miguel Labrador** (CSE), *Programming NXT Robots to Play Soccer.*

FACULTY & STAFF NEWS

Piyush Koria, assistant professor (ChBME). Professor Koria's teaching and research interests are in tissue engineering, biomaterials, drug delivery, nanomedicine, protein engineering and BioMEMS. He received his PhD from the University at Buffalo, SUNY.

Robert Frisina, professor (ChBME) received his PhD from Syracuse University. His multidisciplinary research includes the fields of auditory and molecular neuroengineering with a special emphasis on age-related hearing loss.

Arash Takshi, assistant professor (EE). Professor Takshi's teaching and research interests are in bio and organic electronics,

particularly photovoltaic devices. He received his PhD from the University of British Columbia.

Andrew Raij, assistant professor (EE) received his PhD from the University of Florida. His teaching and research interests primarily lie in the intersection of personal sensing, computer graphics and human-computer interaction.

Professor **Salvatore Morgera** (EE), FIIIE, PE, and Professor **Ashok Kumar** (ME), FAMS, have been named Fellows of the American Association for the Advancement of Science (AAAS), based on their contributions to the advancement of science.

Professor **Vinay Gupta** (ChBME) participated in the National Academy of Engineering's second Frontiers of Engineering Education as one of only 53 of the nation's most innovative young engineering educators. Gupta was the only professor in Florida selected.

Professor **James Mihelcic** (CEE) was inducted as a Board Trustee with the American Academy of Environmental Engineers (AAEE) at the fall board meeting in Chicago. He is also a Board Certified Environmental Engineering Member with the AAEE.

Associate Professor (EE) **Sanjukta Bhanja** and **Thomas Weller** professor (EE) and assistant dean of research received the William R. Jones Most Valuable Mentor Awards by the Florida Education Fund's McKnight Doctoral Fellowship Program, which recognizes faculty who have provided exceptional mentoring toward student completion of their doctoral degree.

Professor (CEE) **James R. Mihelcic** was appointed by the U.S Environmental Protection Agency to serve on the EPA Science Advisory Board (SAB) for a three-year term beginning November 2010.

A team led by **Pei-Sung Lin**, Program Director, ITS Traffic Operations and Safety at CUTR, had its Comprehensive Motorcycle Safety Program win Project of the Year at the TBITE 2010 Banquet and Award Dinner in December. The program promotes education of motorcyclists and motorists to reduce motorcycle-related fatalities and injuries in Florida.

Distinguished University Professor (CEE), **Alberto Sagüés**, PE, was named a Fellow of NACE International, the corrosion society, for his contributions to the fields of corrosion and its prevention. Sagüés holds a joint appointment with ChBME.

THE COLLEGE HELD ITS LENGTH OF SERVICE BANQUET IN JANUARY HONORING 2010 SERVICE ANNIVERSARIES FOR FACULTY AND STAFF.

25 Years
Alberto Sagüés
Ravi Sankar
Lee Stefanakos

20 Years
Larry Dunleavy
Kate Johnson
Wilfrido Moreno
Trung Nguyen

15 Years
Pummy Bedarahally
Ken Christensen
Donna Everhart-Reno
Ed Kellner
Pam Lapaugh
Jian Lu
Karim Nohra
Carla Webb
Tom Weller
Michael Weng

10 Years
Shekhar Bhansali
Jay Bieber
Janet Davis
Eva Fernandez
Tom Gage
Rob Gregg
Amber Reep
Rudy Schlaf
Ken Short
Wendy Teague
John Wolan
Ali Yalcin

5 Years
Nathan Crane
Jeff Cunningham
Alex Domijan
Yusuf Emirov
Yogi Goswami
Anda Iamnitchi
Susana Lai-Yuen
Craig Lusk
Kingsley Reeves
Alex Savachkin
Paul Schnitzler
Daniel Simkins
Sylvia Thomas
Rahul Tripathi
Jing Wang

Bull-arney

For 15 years, Bull-arney has raised funds for programs, scholarships and conference presentations for USF engineering students. Thanks to all the sponsors and volunteers who made this event possible.

All photos by Roger Cox.

USF ALUMNI ASSOCIATION ENGINEERING

Bull-arney tradition mandates the Dean gets a pie in the face. Highest bidder Dave Scott of HSA Engineers & Scientists delivers the pie to Dean John Wiencek

Bull-arney conga line!

Dancing at Bullarney

Celebrity waiters and alums: Robert Garcia as the Sultan of Ybor and Pete Danile as "Booze" Brother Elwood

Alum Carissa Giblin and character actor Paddy O'Furniture

WRAPPING Bridge Piles to **MINIMIZE CORROSION**

It's not the concrete that is deteriorating, it's the reinforcing steel that's causing the problem.

Skimming the sparkling waters of Tampa Bay, the Gandy Bridge is a magical, three-mile drive linking St. Petersburg to Tampa. Where dolphins and fishing dinghies once bobbed, motorists drive a few feet above high tide. Storms dash the shallow waters against the concrete piles and cover the roadway in foam and spray. Whether driving over it or boating under it, the Gandy is an engineering marvel. Smooth and solid over the bay, it is a far cry from the crumbling images of America's infrastructure - a world apart from a rusting iron bridge in Chicago, or a collapsing span over the Mississippi. However, the current Gandy is actually the forth incarnation of the original structure which opened in 1924. Wait, the fourth bridge in less than 100 years? What's up with that?

Mapping corrosion state of piles before FRP wrap

There are over 600,000 bridges in the United States, and according to the American Association of State Highway and Transportation officials, one out of every four bridges is in need of repair or upgrade. The U.S. Department of Transportation states that many bridges are carrying more traffic than they were designed to bear. And the Federal Highway Administration states that 25% of the nation's bridges are structurally deficient or functionally obsolete. The price tag? Somewhere in the neighborhood of $140 billion, give or take. Between the media frenzy of bridges to nowhere and the realities of bridges collapsing somewhere, is anyone actually doing anything about this?

At the University of South Florida, two civil and environmental professors are addressing the need to efficiently, effectively and economically repair one of the basic building blocks of bridge engineering – steel reinforced concrete. Professors Rajan Sen, PhD, PE and Gray Mullins, PhD, PE have received grants from the National Science Foundation, the Transportation Research Board, the Florida Department of Transportation and Hillsborough County to investigate the science and application of using fiber reinforced polymers (FRP) to wrap partially-submerged steel reinforced concrete pilings. Focusing on bridges in Tampa Bay, their research is applicable to all sub-tropical climates where heat, humidity, saltwater and tidal influences affect thousands of concrete piles that hold up miles of bridges and causeways. Like the concrete piles that hold up the Gandy Bridge.

Set up for wrapping piles supporting Friendship Trail Bridge

"We have wrapped many piles on the Gandy and the Friendship Trail Bridge and the Allen Creek Bridge, but you have to get in a boat to see our work," explains Prof. Sen. "High temperatures and high humidity actually accelerate the process here in Florida. The corrosion rate in Newfoundland, for example, is much lower than it is in Florida. It is a problem in all sub-tropical environments, so if we find an inexpensive and efficient way of doing it here, then people can use it all over the world."

The use of steel reinforced concrete is only a little over 140 years old. Joseph Monier, a French gardener, started using iron mesh to strengthen cement containers. He obtained a patent in 1867, and promoted its use in iron-reinforced cement pipes and beams used in bridges.

ENGINEERING STUDENT ELECTED VICE PRESIDENT OF STUDENT BODY

February 24 marks a day in USF history that holds particular importance for the USF engineering community — it's the day **Zachary Johnson**, a senior engineering student, was elected to be Student Body Vice President.

After three weeks of intense and grueling campaigning, Johnson and his running mate Matt Diaz won the Student Government election with more than 51 percent of the vote.

Winning in the first round of SG elections is highly unusual. In the past decade, it's only happened twice. On both those times, only two tickets entered the race so that outcome was guaranteed. In this case, there were four tickets and a run-off was expected.

"Getting elected took an unbelievable amount of effort. Our primary focus was engaging as many people as possible, personally talking to as many students as we could. The week of the election, we were out 12, sometimes 15 hours a day. I wouldn't dream of trading the experience away though, the feedback we got from meeting so many of our peers was daily motivation to succeed," Johnson said.

Johnson and his running mate, Matt Diaz ran on the platform that the President and Vice President are student servants whose jobs are to enact the agenda of students instead of their own. They decided to seek office out of their desire to further unite the students.

"In my two years serving as the students Chief Financial Officer, I've had the ability to work hand in hand with some of our USF administrators on issues related to student fees and budget allocations, which is critically important when considering the financial status of our state university system. Matt and I identified a huge opportunity to help engage students on these challenges, in addition to the various social, political and university issues. We both agree that there needs to be focus on improving the engagement of our students on these topics, it just kind of made sense to run."

Johnson is a senior chemical engineering student who's very active within the engineering community at USF. This semester he coordinated an Engineering Leadership Conference with Theta Tau Engineering Fraternity and Tau Beta Pi Engineering Honor Society, hosting 200 students from the Southeast United States. He is also active in the American Institute of Chemical Engineers, Engineering College Council and Pi Kappa Alpha Fraternity.

Johnson believes that his background as an engineering student will make him a valuable voice within student government.

"Having the engineering perspective is not something we often have at this level of the university. The engineering community deserves someone who can voice their interests at that level. My role as vice president will enable me to impact both the academic affairs and student life of USF for years to come."

Diaz and Johnson take office as President and Vice President May 9, 2011.

So why are the concrete piles of a relatively new structure, like the Gandy Bridge, in danger? "It is not the concrete that deteriorates," explains Sen patiently. "It is the reinforcing steel that corrodes and expands six to ten times larger than its original size. This sets up stresses in the concrete, which then cracks. It gets worse and worse with time." Most of us have some visual idea of a rusting re-bar encased in concrete. But the situation where reinforced concrete is exposed to saltwater is far more insidious. "Water and chlorides (basically salt) diffuse through the concrete cover," says Sen. "We always protect the steel with a plain concrete cover, typically three inches thick. But after about ten to twelve years, the salt reaches the steel surface. And that is when the corrosion process starts. Also these concrete piles are driven. When you drive them into the ground, sometimes cracks develop. Moisture, oxygen and chlorides will always get in through these cracks."

There are over 600,000 bridges in the United States, and according to the American Association of State Highway and Transportation officials, one out of every four bridges is in need of repair or upgrade.

Three separate field demonstration projects have been undertaken using fiber reinforced polymers in the Tampa Bay area by Profs. Sen and Mullins. Newly-developed resins that can cure in water coupled with the strength of commercially-available fibers are at the core of the repair system. "Like wallpaper, these advanced composites are saturated with the appropriate epoxy," explains Sen. And like any wallpaper project, the surface must be clean and smooth. "Preparation takes times because you have to remove all the marine growth from the pile. And if there are any depressions you have to patch repair them. The edges have to be rounded. Sharp corners are hard to wrap – that takes some work." The wet bonding process is a very important step in the wrapping, and the University has applied for a patent to improve this technique.

View of finished piles

Depending upon the location, simple ladders or scaffolding are constructed around each pile. The epoxy-saturated fabric is carefully wrapped around the prepared concrete surface. It is important to match the direction of the fibers according to the role abandoned by the corroding steel. Fibers are laid parallel to the direction of the steel to provide flexural capacity (the original purpose of the steel itself), and perpendicular to the steel to fight against the expansive forces caused by the steel's corrosion. Both carbon fiber and fiberglass materials were used in the demonstration projects. The careful application of a good bond and the multiple directions of the fibers can restore the concrete pile's original strength.

"We use linear polarization to measure the corrosion rate," explains Sen. Electrical probes attached to the steel reinforcing bars measure the efficiency of a FRP-wrapped pile compared to un-wrapped control piles that are exposed to the environment.

"We are just a university, and if people take a close look at our techniques, they will be able to improve on what we have done," Sen says modestly. "There is equipment which allows the surface preparation to go faster than ours," he adds. But to wrap it up, restoring the integrity of thousands of tidal-zone concrete piles with inexpensive materials is just one of many examples of inspired engineering that you will find at USF.

Prof. Rajan Sen is the Chair (with Co-Chair) of FRPRCS10, the most important conference in concrete applications for FRP hosted by the American Concrete Institute (ACI) being held in Tampa this April. His graduate students will be making presentations on the history and reliability and new applications of FRP used for corrosion repair.

In January Rajan Sen and Gray Mullins received a U.S. patent #7,871,483 B2 "Bond Enhancement for Underwater Repair."

For more information, contact: *sen@usf.edu* or *gmullins@usf.edu*.

COMPUTER PIONEERS ESTABLISH USF SCHOLARSHIP

A new scholarship is available for computer science and electrical engineering students. The Schnabel-Sparacio Scholarship has been established by Dorothy Schnabel and her late husband Frank Sparacio. Those are the facts. But the story behind this scholarship is not just one of giving back, but of going back.

In 1990, Professor W. Clark Naylor hired a research assistant for the Computer Science Department at USF. Dorothy Schnabel answered the call, and brought thirty years of experience with IBM to the position. Thirty years of experience? We'll do the math here for you.

The new research assistant had graduated from City College of New York with an electrical engineering degree in the early 1950's. Dorothy Schnabel was one of the few women, one half of one percent, of all the engineering graduates that year. She had been elected to the electrical engineering honor fraternity Eta Kappa Nu. She could not get in to Tau Beta Pi, because women were not allowed to hold full memberships. During her three decades at IBM she saw the demise of the analog computer industry and the birth of the digital revolution. She wrote assembly programs and worked on sensitive government code cracking projects. Dorothy was no ordinary research assistant.

Frank Sparacio, Dorothy's husband had also pioneered much of what the current crop of computer science students take for granted, parallel processing and high-performance scientific applications. A graduate of Rutgers University, Frank held over 30 patents.

"We both received scholarships," explains Dorothy. "Both Frank and I would have had a very difficult time getting an education. The field of computer science was in its infancy. My school, CCNY, had a few courses in digital computing," she adds with a note of pride, "but Rutgers did not."

Dorothy and Frank were years ahead of their time. In the 1950's Dorothy kept her maiden name, which was practically unheard of outside of a few movie stars. "Frank had his publications, and I had mine," she explains briskly.

"Our education enabled us to use our talents and interests in very fulfilling careers, and to earn good wages," explains Dorothy when asked about why they started this scholarship. "We enjoyed a comfortable living, but more importantly, we were able to contribute back to society." Like many people who are involved in philanthropy or scholarships, Dorothy speaks with profound humility. "We were privileged to get an education that made our lives better," she explains patiently. "We feel we have an obligation to give back to society, in some way or another."

Frank Sparacio passed away two years ago. But he and Dorothy had decided to establish a generous scholarship for students who lacked sufficient financial resources. "Both Frank and I have long felt that the study of engineering should be encouraged, as well as studies in the fields of math and science," says Dorothy. "We therefore have chosen to establish a scholarship for a student who studies either electrical engineering or computer science. Our country should be a leader in these fields."

Dorothy recalls her research assistantship at USF with great fondness. As one of five women engineering students in her school over 60 years ago, she celebrates the diversity of students at USF with her generosity. "I had the privilege of working for a few years in the Computer Science department at USF," she says, "I got to interact with the students and faculty."

Dorothy Schnabel, thank you, but it's our privilege to have worked with you. You and your husband's engineering contributions to computer science and now to scholarships at USF for engineering students is indeed, the truest form of giving back.

For more information on how to establish a scholarship fund for the College of Engineering, contact Brett Woods *bwoods@usf.edu* or 813-974-9199.

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

Brett L. Woods, CFRE
Director of Development

In this era of diminishing public resources available to state universities, development is more important than ever to Deans and their colleges. Dean Wiencek and I recently attended a "Development for Deans" conference sponsored by the Council for the Advancement and Support of Education (CASE). The conference was attended by Deans and their Development Officers from across North America. Faculty presenters for the conference included Ed Kvet, Provost and Vice President for Academic Affairs at Loyola University in New Orleans and Don Gray, who holds a Ph.D. in Chemical Engineering, and has served as a Dean and also Vice President of the University of Wisconsin Foundation. Ed and, particularly, Don were able to speak in unique ways about the role of development at the college level.

What do we mean when we speak of development? According to Don Gray, "Those engaged in *development* spend the time, energy and generosity in *developing* the relationship that will *develop* an interest that will *develop* an emotional connection that will *develop* a desire to do something significant that will *develop* the College and on and on." Development is a continuum of involvement, engagement investment and continued involvement. It is a process that yields gratifying outcomes for all involved.

Many of you tell us your association with our students and faculty is a meaningful experience for you and you invest in your future and our future by investing in theirs. You give in honor or memory of someone. You may give because someone once helped you with a scholarship. You may give because your education and experience at USF helped you to become what you are today. No matter the motivation, the outcome is the same.

We are thankful and grateful to our 617 supporters that have made gifts and donations to support us this year. For those considering a donation or gift, your support will make an ever increasing difference as the balance shifts toward even greater reliance on private philanthropy.

"It is one of the beautiful compensations of this life that no one can sincerely try to help another without helping himself."

-Ralph Waldo Emerson

As you explore this edition of Envision, you can't help but notice all of the ways the College, our students, faculty and staff are impacting the quality of our lives – from safer infrastructures, to better health care to better hearing – the USF College of Engineering is, **thanks to you**, making differences we can feel, see and hear.