REAL-WORLD EXPERIENCE

Civil Engineering students travel to Bolivia to work with local engineers on wastewater project

Mitigating Pandemic Outbreaks—Research performed by IMSE professors could help minimize the spread of future pandemics

New Director for NNRC—ME Professor envisions a multifaceted future for the Nanomaterials and Nanomanufacturing Research Center

EAS Bull-arney 2010 Event—14 years of fundraising in zany costumes

How do you transform a system that was built when steam locomotives and gas lights were the latest in technology? The power “grid” as we know it today was conceived in the minds of brilliant inventors, nurtured by a few wealthy entrepreneurs, broken up by presidents and regulated by commissions. And that was just the first 100 years. This mighty project of iron, copper and the mysterious flow of electrons is fragile. It is susceptible to hurricanes, ice storms, heat waves and human error. It cannot, in its present state, accommodate renewable and distributed power generation capabilities nor can it wean itself from fossil fuels. What does it take to bring one of the largest structures ever built by mankind into the 21st century?

Meet Dr. Alex Domijan, Jr., Director of the Power Center for Utility Explorations (PCUE). “It’s going to require a fundamental transformation,” explains Professor Domijan. “Our grid really needs an infusion of new ways of operation, new ways of thinking. You have to capture people’s imagination. And it will take leadership to influence the system with the finances and collaborations necessary to just start actually doing things.” And doing things is what Domijan and PCUE are all about.

In addition to providing power courses for undergraduate and graduate students in the Department of Electrical Engineering, PCUE explores all energy-related issues regarding generation, transmission and distribution of electricity and embraces a multi-disciplinary approach to current industry issues and future grid design and management. In just three years, PCUE went from zero to more than $7 million a year in competitive and sustainable funding. Its board of directors represents utilities, manufacturers and energy companies. Its Power and Energy Applied Research Laboratory (PEARL) which can monitor power systems worldwide is available for testing and analysis. But what sets PCUE apart is a series of successful initiatives that captures the public’s imagination and the industry’s collaboration.

About 20 years prior to establishing PCUE, Domijan gave a lot of thought to the aging U.S. grid system. “A group of professionals and I came up with what a power system should be,” he explains. “We call it “FRIENDS” because it is a Flexible (can survive disasters), Reliable (energy 24/7), Intelligent (allowing for consumer interaction and many other items), Electric eNergy (power in all its many forms from renewable to central station) Delivery System.” There are several major differences between the grid we have now and a FRIENDS infrastructure. The current grid is strictly a one-way road, with power generated from centralized stations, transmitted vast distances and distributed to consumers. The FRIENDS smart grid accommodates both centralized power and distributed power generation such as wind farms and photovoltaic power plants. It is also a multi-lane system with the finances and collaborations necessary to just start actually doing things.

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Riding on Sunlight at the Zoo

One of the most amazing examples of the energy SEEDS being planted is the Lowry Park Zoo’s Treetop Skyfari Sky Ride. Located in Tampa, the popular zoo is home to over 2,000 animals and welcomes over a million visitors per year. A 15-kilowatt solar photovoltaic system has been installed that completely powers the Sky Ride. Generating enough electricity to power three homes, solar panels were installed on top of structures that provide the elephants in the exhibit with shade, cooling and convenient poles to scratch those elephant itches. Totally unobtrusive, neither people nor pachyderms are aware of the generating station placed in their midst. Using the FRIENDS design, the miniature “smart grid” can also return power back to charge electric vehicles or provide emergency power in an outage. In addition, the multiple benefits from the installation are a testament to collaborative efforts across many disciplines. Partnering with Tampa Electric Company (TECO) and USF, the project was funded by TECO and a grant from the Florida High Tech Corridor Council. Also located in the Safari Africa plaza is the Renewable Smart Grid Learning Center. A contest among 200 USF School of Architecture and Community Design students provided “real world” experience for the students in concepts, designs and collaborative efforts. The Learning Center showcases the benefits of sustainable electric energy to over a million visitors a year. The Sky Ride and Learning Center are just two of the FRIENDS projects undertaken by PCUE. Because of their strategic placement in the public eye, they provide tangible evidence that a clean energy future is economically and environmentally possible.
highway of information between supply and demand, consumers and utilities, and is an intelligent network aware of weather conditions, potential disasters and energy quality.

So how do you get your old 19th century grid into the 21st century? “It’s going to be a long haul, and eventually it is going to happen. It took a hundred years just to get to our present point, so it will be at least 50 years or so before the whole thing will start coordinating and working together,” explains Domijan. A look back at the last 100 years will help define where we are now.

In the 1880’s, it was gas vs. electricity. People actually thought that electric light bulbs were more dangerous than gas lights. But it was the use of electric motors in homes and industries that created the tipping point. Electric lights and motors saturated the market, creating more demand and creating the first big spike in electricity consumption. The “vertically distributed system” that we have today was created by a handful of businessmen who joined the exclusive club of oil magnates, railroad tycoons and investment bankers. The vertically distributed system divided the electric business into three components we still use generation (coal/oil-fired power plants, hydroelectric dams), transmission (the high voltage lines stretching over vast distances), and distribution (the stepped-down power lines going to homes and businesses).

By the 1930’s, economic turmoil, World War I and the Great Depression caused the demand to “flat line.” Electric companies concentrated on the money-making metropolitan cities, ignoring the rural areas. Franklin D. Roosevelt was elected partly on the promise he made to break up the power companies, and in 1935 Congress passed the Public Utility Holding Company Act that regulated electric utilities by confining their operations to a single state or a limited geographic area. This breakup actually spurred more investment in the now state-regulated utilities. Eventually, power came to rural areas. Again, in the 1940’s, World War II caused the second big spike in consumption, with manufacturing switching to wartime production and the expanding post-war economy.

Now we are at the threshold of the next big spike. In trying to get an idea of what we are facing, you have to do a little time travel. “Think back to your great-grandmother living back in the 1880’s,” challenges Domijan. “Could those people really imagine what things were going to be like in the 1940’s with industrialization? Not even people in the 1940’s could have predicted what we have today. And now we are at a similar point with economic turmoil. We are at a point where the grid is very fragile. People want electric cars and they want renewable energy,” he continues, “but it is not cost-effective yet. It’s going to require a fundamental transformation that may not happen unless well-trained people come in and start thinking about this.”

So how do you get this transformation started? With seeds of course. One of the most visible and successful PCUE initiatives is Sustainable Electric Energy Delivery Systems, or SEEDS. The Lowry Park Zoo (see side story) is a working installation of a cost-effective and renewable smart grid. People can see it and touch it, which leads to businesses inquiring about it, which leads to television and Internet coverage, which leads to more and more consumers demanding their utility companies use it, and slowly but surely we will lug our outdated grid into the Internet age.

Professor Domijan goes on to explain, “You have got to really change the customer’s perception and the customers have to see a value in what you are doing.” Doesn’t this sound like a marketing plan? “Well,” he winces a bit and adds, “I’m an engineer, but I actually build stuff too. You have to deliver what you promise.”

The interest generated by the various SEEDS projects is evident. “I have gotten the interest of developers for housing communities, for golf courses, and even the race track approached me about a battery system to light their track in the evening. So there are a whole bunch of people now, they start seeing it and now they want to do it. And that’s how you begin.”

Between 1880 and 1940, the average person used 1,100 kilowatt/hours per year. Today, that number is ten times that, or 10,000 kilo-watt/hours per year. No one knows what that number will be in the future. There is a strong correlation between energy and people’s quality of life. “We want to make it so that people have the ability to get good quality energy that is there when they need it,” he explains. “It is up to people to accomplish or create businesses that will develop out of this. It will foster new businesses and new industries.”

There is also the dark side of this issue. If we do nothing, we will not see that next big spike. What if the country’s power supply had not been partitioned neatly into a package that makes a whole lot of sense for our students and our community? What if we are now.

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PCUE—cont’d.
kept pace with 20th century demands for industrialization or a few holding companies still controlled the nation’s power? “We would still be in the steam age,” Domijan ponders this question. “So try to imagine today, what will it be like in 2060? We have to be like Jules Verne, and try to imagine things, wonderful things. And you want those things to be good.” He pauses and adds, “I think the common domi-
ator here is just to increase the electrification and it will come about. Whatever it is. New things, new abilities to communicate with people, interactions between people, certainly the technology will enable some of those things to happen. So, hopefully, that will be good. It will increase productivity and increase the standard of living for people. That’s the key, to increase everybody’s standard of living.”

But building more power plants and simply providing more electric-

What can the average person do to bring about this change? “Make your utility company and your elected representatives aware that you are interested in renewables, that you are interested in the grid. Encourage representatives to fund and actually deliver something rather than just a lot of promises.” Like the SEEDS projects that actu-

Approximately half the 85 graduate students are BME majors. With

A FRIENDS project for small businesses is the Advanced Commer-
cial Energy (ACE) Technology initiative which partners with TECO. It will install tools for small businesses such as dental offices that will allow businesses to monitor and control their energy efficiency. About

500 businesses are slated for this FRIENDS project. “Again,” says Domijan, “this is all very tangible, it affects people’s daily lives. Being able to show the public and really getting these collaborations going, that’s how I am able to generate so much interest and funding for our projects.”

Bill Lee: Investigation of the performance and design of orthopedic implant devices.

New Biomedical Emphasis in the College of Engineering

Growth of the Biomedical Engineering program received significant support and emphasis by hiring additional faculty and a University of Rochester research group’s move to USF.

Robert Frisina joins the BME faculty this fall when the research group he leads moves here from Rochester. Three members of that group will join USF’s College of Behavioral & Commu-

Vinay Gupta: Research in the broad area of surface science and polymer science with specific focus on design of novel nanomaterials critical in practical applications such as chemical detection in the environment, biocompatibility, drug delivery, smart materials.

Richard Gilbert: Research activities focus in two sectors: Cancer Translational Treat-

Another high-profile SEEDS (a subsystem of FRIENDS) has been installed at two sites in St. Petersburg with Progress Energy Florida and also with the Florida High Tech Corridor. These will serve as hubs and will test photovoltaic panels and an innovative storage system to supply additional power during times of peak demand.

FRIENDS projects also have multiple uses. For example, the Lowry Park Zoo Sky Ride not only provides power to run the ride, but the structure provides shade for the elephants. In an emergency, the power could be used to run pumps or other equipment. Future electric vehicles could be charged on this small smart grid. “So the more multiple uses you can have, the better it is,” Dr. Domijan explains. “It requires a lot of vision and thinking to put this together. And that’s what I am trying to do—have competent people work together not just at USF but also state-wide and nationwide as well.”

He adds, “The PCUE team, our Deputy Director, Arif Islam, and professors Aleksander Damjanovic, Lingling Fan, Zhixin Miao, Deok Kim, Carlos Alvarez, Jeremy Susac, Trent Green, our USF faculty associates and the many undergraduate and graduate students, and the PCUE board (Tampa Electric Company, Progress Energy Florida, Florida Power and Light Company, Sumter Electric Coop-

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“Our research is about is trying to make this transformation happen,” concludes Professor Domijan. “Our children’s children will be able to take advantage of these things in very creative ways. Who knows what the future holds? We cannot answer that, but we all can work toward making it clean, renewable and reliable.

For more information, visit http://pcue.eng.usf.edu/.
In 1918, a virulent form of H1N1 avian flu swept in three distinct waves across Europe, Asia and North America. The greatest pandemic in history killed an estimated 50 million, 3% of the world's population at the time. One-third of the world's population had been infected.

Misnamed “Spanish Flu,” the disease probably originated in Haskell County, Kansas in March of 1918. In addition to raising farm boys about to be soldiers, Haskell County also raised chickens and pigs. The local doctor, Loring Miner, noticed that as the young men were being assigned into nearby Fort Riley, the strongest and most robust were laid low by influenza, many progressing into pneumonia. Dr. Miner wrote to the public health officials of his experiences. His report has provided historians and epidemiologists with one of the most remarkable clues in the search for the origin of the deadliest pandemic in history.

Today, the 1918 influenza pandemic is used as a model by the epidemiologists. It is an example of how a modern-day influenza pandemic can devastate populations thousands of miles away from its source. In World War I, as the young men from Kansas were shipped throughout the country for training, and then to England and France, the soldiers’ morbidity (sickness) and mortality were well documented. But because the Allies did not want their enemies discovering the epidemic among their soldiers, the only flu coverage most Americans got was from the newspapers of neutral Spain.

Fast-forward to 2009. Three more influenza Type A pandemic outbreaks have caused hundreds of thousands of deaths. Can we utilize data from the past pandemics to model future outbreaks? How do we control and mitigate the effects?

During outbreaks, the policy makers face critical decisions. When to close and reopen the grade schools, colleges, and universities? When to recommend workplace closure? When to call for voluntary quarantine and isolation? Which population strata should be vaccinated? Who should be hospitalized/isolated and who should be allowed to recover at home? When to call for mandatory quarantine?

Professors Tapas Das and Alex Savachkin, of the Department of Industrial and Management Systems Engineering, in collaboration with Professor Yiliang Zhu of USF College of Public Health and Heide Castañeda of the Dept. of Anthropology, have been developing a unique approach to modeling large scale cross-regional outbreaks to support national and regional policy makers in pandemic preparedness and response. Their model is a simulation-based optimization approach. It tracks every person’s contacts with other individuals in a given region, hour by hour, during the entire pandemic period. The model incorporates regional demographics comprising population, business and social infrastructure and their spatial configuration, and inter-regional travel.

“Every model has to have two sub-models,” explains Savachkin. “A disease progression model, which considers population transition among disease compartments including susceptible, contacted, infected, and recovered/deceased, and a disease natural history model that considers latency period of the virus, incubation, infectiousness, mortality rate and so forth.”

The regions inside the network are classified as unaffected, ongoing outbreak (which includes new outbreaks), and contained (Figure 2). The regions are interconnected by air and land travel. The objective function of the optimization model incorporates measures of morbidity, mortality, and social distancing, translated into the cost of lost productivity and medical expenses. The model strives to minimize the cost of the new/ongoing outbreaks and the expected cost of the potential outbreaks, spreading from the ongoing regions. Detailed daily pandemic statistics are collected for each affected region, including the numbers of new infected, deceased, and quarantined cases, for different age groups. As the regional outbreaks become contained, the model estimates their actual societal and economic costs.

Das and Savachkin have examined a sample cross-regional H5N1 outbreak scenario affecting four counties in Florida: Hillsborough, Miami Dade, Duval, and Leon, with populations of 1.0, 1.2, 0.8, and 0.25 million people, respectively. Demographic and social dynamics data for each of the regions were extracted from the U.S. Census and the National Household Travel Survey. The disease natural history for H5N1 virus subtype was taken as the following: a latent period of 29 hours, an incubation period of 46 hours, and an infectious period of 3 days, respectively. The simulation model was calibrated using two common measures of pandemic severity: the basic reproduction number and the infection attack rate.

The USF team compared their model-based allocation strategy with the existing governmental pro-rata policy, which allocates resources simply in proportion to the population size. The model-based strategy yields results which consistently outperforms those of the pro-rata distribution policy, for different levels of resource availability.

Obviously practicing on past pandemics fine-tunes your current model. But as Professor Das explains, “Part of our goal is to make our methodology connect to databases on a real time basis. The program has real value running off line with different scenarios. But the real use of this program is to make it run on a real-time basis while the disease is in progress. It can collect, in real time, the demographics of a region and how the disease is spreading. We could predict in advance, the number of infected people and the number of deaths. The computer model should also be accessible to the policy makers so that they can run various what-if scenarios and decide the best actions. This, we believe, will significantly advance the current means of public health pandemic response.”
The Topsy-turvy Factor in College Football

Discussing and disputing the games of the season against the games of the past is a time-honored tradition of sports fans. Passions are born and beer consumed when reminiscing about a particular season being “wild” or “topsy-turvy.” Sportscasters become increasingly apoplectic each week in their attempts to describe this situation. Maybe this increases ratings. But what is it, exactly, that makes one season a ho-hummer (except if your team wins, of course) and another season turns into a chaos of triumph and tragedy? In these seasons of upssets and missed field goals, we are mesmerized by watching the mighty fall, over and over again, to the underdog, going unnoticed.

Since early man (and we know he was a man, for reasons not covered in this article), threw a rock and challenged his buddy to throw one farther, athletic accomplishments have always been lovingly recorded by those of a more analytical nature, the statistsicians. Joe the Gladiator would have been just a smear of graffiti on the Colosseum wall if the scribes had not kept track of the number of lions, fellow gladiators and assorted Christians he dispatched in the prior season. Sports cannot survive without statistics.

So what kind of statistics do we have that describe not wins and losses, but the nature of a single week or season? How to quantify and define a “wild” season over another, more predictable season? Thanks to Dr. Autar K. Kaw, professor of Mechanical Engineering, and Dr. Ali Yalcin, associate professor of Industrial & Management Systems Engineering, we now have a metric, a number (always positive!) that will settle arguments and preserve friendships for seasons to come.

“Imagine a bunch of football fans sitting around the couch on a Sunday and talking about what a wild week it was,” says Dr. Yalcin. “One claims: ‘It was the wildest he had ever seen in college football!’ Another fan counters: ‘It wasn’t that wild, this team lost to that team that was totally predictable.’ So our math ensures that instead of getting into a brawl and hurting each other, they can actually calculate it, put a number on it!”

Dr. K. Kaw explains how he approached the definition of topsy-turvy, and we are not talking about the Middle English term meaning to overturn. He wanted to quantify, or assign a value to a season that would immediately indicate its volatility or predictability. “I thought the more the guy talked about a wild week or a topsy-turvy week, the more people would tune in to see what the heck was going on with the college report. So, it was interesting figuring out how we can quantify this. That’s how it all started in 2007,” says Dr. Kaw.

Weeks make up a season, so it was necessary to assign a number to a week. Dr. K. Kaw calls this number Week TT Factor. This weekly number is handy when our couch-loving fans get together. Instead of one-upping each other in volume, eye-rolling and potential violence, they can discuss the Week TT Factor, a number between 0 and 200.

The resulting Season TT Factor is calculated after each week to gauge how topsy-turvy the season has been so far. At the end, the Season TT Factor is the defining value of the volatility, disarray, chaos or whatever mathematical term you choose for the entire season. According to this methodology, season 2007 came in with a whopping Season TT of 50, and Season 2004 with a snoozer of 33.

The complete Week TT Factor and Season TT Factor figures are available on the website at http://www.eng.usf.edu/~kaw/ttfactor/index.html. This is one of the most popular websites at USF, and has produced some topsy-turvy bandwidth issues of its own.

Dr. K. Kaw explains how the weekly topsy-turvy figure is arrived at. “At the end of each college football week, the Associated Press (AP) poll rankings are calculated by polling 65 sportswriters and broadcast sportscasters. Each voter supplies his or her ranking of the top 25 teams. The individual votes are added by giving 25 points to the first place vote, 24 points to the second place vote, etc. The addition of the points then produces the list of the AP top 25 teams of the week.” Those team rankings are compared to the previous week’s rankings. The difference between the current and previous rankings is calculated and then squared. Why squared? “It allocates proportionately higher importance on bigger week-to-week changes in rankings for a given team,” explains Dr. K. Kaw. These squared numbers are added together and then normalized by the average of the lowest and highest possible value of the sum and multiplied by 100. This produces a Week TT factor between 0 and 200.

If you are still a little fuzzy on this concept, try Dr. Yalcin’s simplified explanation. Five teams, A, B, C, D, and E are ranked by experts. To make it easy, A gets the most votes, and E gets almost none. Teams C and D have just a couple of votes difference. It is a far bigger catastrophe if A gets thrashed by E, than if C gets beat by D. Teams C and D have just a couple of votes difference. It is a far bigger catastrophe if A gets thrashed by E, than if C gets beat by D. And to prove all of this, if the rankings remain exactly the same, and the projected teams win, then the TT factor is a big fat zero. While the chances of this are practically nil, it proves the methodology. A number above 54 is considered “very topsy-turvy” and under 30 is “predictable.”

The individual weeks and seasons since 2002 are all available on the website. This methodology can be applied to anything that is ranked such as baseball, tennis and basketball. The bad news is that the TT factors, both weekly and seasonally, are random - maybe not as random as roulette, but still, nothing here to take to the bank. But, if you are willing to bet that is 2007, week 5 beat the daylights out of week 3 in 2004, you can take that bet to the bank.

by Janet Dawald

So before you launch your spreadsheet program, be aware there are some serious pitfalls. What about the unfortunate teams who fall outside of Week 3 rankings? And those lucky underdogs who were unranked in Weeks 1 and 2, but have now joined the crest of ranked teams? This involves some serious drawbacks concerning the fact that a paltry one or two votes is not really a true ranking, but all teams get unranked, and a host of other issues best covered in the articles on the website. Normalization numbers, formulae and other measures of disarray are clearly defined; the numerically-challenged among us can actually get a grip on how the professors worked out these dilemmas.

In reality, the topsy-turvy factors are a measure of disarray. It does not measure individual teams’ chances of winning. Because the base data is actually a set of opinions (albeit expert opinion), as opposed to win-loss statistics, the formula describes the changes between what is predicted and what actually happens. And if graphs showing parallel trends make your heart stop, be sure and check out the comparison on the website between the AP poll and the USA Today poll. Using the same formula, Dr. K. Kaw and Yalcin used the rankings by 63 head coaches in Division I-A, the USA Today experts. Using the same 25 votes for first place, 24 for second, the top twenty-five teams were created. The difference between using AP and USA Today for calculation of TT factors was less than 5%.

The other teams could make trouble for us if they win —Yogi Berra
Professor Kumar is New Director of NNRC
by Janet Dawald

Dr. Ashok Kumar, Director of the NNRC and Professor of Mechanical Engineering, brings an interdisciplinary approach to his work. Grounded in Materials Science and Engineering, he applies the concepts of syntheses, structure, properties and performance to understanding these principles at the nanoscale. “My research is focused toward the development of nanomaterials including nano-coatings, nanowires, nanotubes, and nanoparticles using various physical and chemical vapor deposition methods for multifunctional applications” says Dr. Kumar. “My other interests include K-12 educational outreach, gender and science education and nanotechnology industrial outreach.”

Nanotechnology is a relatively new science, but the practice of controlling matter on a molecular scale really took off in the 1980’s with the invention of the scanning tunneling microscope. The Metrology Suite of the NNRC houses several types of scanning electron and atomic force microscopes, diffractometers and focused ion beams. Dr. Kumar is awaiting delivery of a brand-new high resolution scanning electron microscope, equipped with enough enhancements and attachments to keep any scientist happy for years.

In addition to the Metrology Suite laboratory, the 15,000 square-foot Nanotech 1 building houses four additional laboratories. One of the most common applications of nanotechnology is the application of a few molecules of a material to a surface. The Thin Film Laboratory specializes in this process, utilizing high-tech plasma sputtering and ion beam sputtering tools. The Device Fabrication Lab/ Cleanroom supports optical contact lithography, wet, dry and ion etching, low pressure chemical vapor deposition, plasma enhanced vapor deposition and other research techniques and processes. Electroplating in solvent and acid/base wet bench applications is the specialty of the Wet Chemistry Lab. The Electrical Test/Package Laboratory boasts semiconductor analyzers, micro-manipulator probe stations and other micro-machining equipment.

So who gets to use all this cool stuff? “Over 60 professors at USF use the Nanotech lab and send their students to train on our tools and techniques,” says Dr. Kumar. “Our user base contains over 250 students, faculty and industrial users. Over 40 local companies use our equipment. These companies’ products and services include nano-based energy scavenging, water quality, optics and failure analysis.”

The NNRC facilities are used for both research and teaching. The Center supports faculty, undergraduates, graduate students and industrial researchers. The equipment and facilities in the Nanotech Lab facilitate research in nanomaterials and nanomanufacturing methods related to fundamental materials science, sensors, actuators, electronics, bio-systems, medical products, optics and integrated micro and nanoscale systems. The toolsets support fabrication of nano and micro devices, material characterization study, and thin film processing. The Center is constantly upgrading the equipment and facilities to keep up with technology and research demands. Support staff includes four engineers who give monthly instruction, consult to all users about the tool capabilities and techniques involved, and keep the high tech equipment running and available for use. One staff member coordinates training and billing, and many student assistants round out the team.

Dr. Kumar has several visions for the future of the Center. The first, he says, “Is to enable multidisciplinary nano-related research projects for all at the University of South Florida. The second would be to advance nanoscale science and technology to improve the quality of life,” he continues. “And also to be a powerful engine that can drive the economic growth of the Tampa Bay region and beyond.”

As many of the top USF scholars and professors agree, an interdisciplinary approach is critical to success. “The Nano Research Center provides user fabrication and metrology center providing equipment, professional personnel and infrastructure to enable multidisciplinary research in nanomaterials and nanomanufacturing methods,” Dr. Kumar explains. “We serve as a nexus for fundamental interdisciplinary research. We can elevate the research capacity of our faculty and students for cutting-edge research, technology transfer, cooperative and educational outreach and workforce development. The NNRC works closely with local industries and other scientific communities to enhance scientific activities, to develop novel technologies, and to train capable scientists.”

“This is a revolution,” says Dr. Kumar. “Nanomaterials are continuously being discovered. These breakthroughs can be expected to continue. Nanotechnology holds great potential and stands to impact a broad range of fields. It offers, for example, the promise of new information processing systems, new disease therapies, and new ways to collect and store energy.”

What does the future hold for this new science? “In the near term, nanotechnology will improve existing devices and systems. In the long term, nanotechnology will lead to an array of entirely new materials and products, with new properties,” Dr. Kumar continues. “Nanotechnology affects almost everyone, every day. The impact of nanotechnologies will continue to grow, benefiting health, security, environmental protection, food safety, and energy conservation. It is already taken for granted as part of everyday 21st century life.”

For more information, visit http://www.nanotechproject.org/inventories/consumer/browse/categories/
T he International Capstone Design program provides juniors and seniors real-world experience in engineering. Concentrating its efforts in Bolivia this year, the ICD is under the direction of Linda Phillips and Dennis Magolan. The program provides field construction with engineering design that parallels what the students will encounter in industry.

The Bolivians are the customer, and the students, along with mentors, provide the engineering feasibility and design reports for projects that have been identified by the customer. Students must take into consideration the social, financial and practical aspects of the project in addition to the engineering concepts of productivity, materials and procurement, schedules and cost factors. The course consists of 6 semester credit hours and 1 credit toward professional/ethics course. Several weeks are spent in-country in small teams of 2-3 students, and the following semester on campus where the design reports and construction drawings are produced.

Linda Phillips has been working in Bolivia for over a decade, developing relationships with community leaders and government officials. She has over 20 years of practical experience as a project engineer and manager.

"Most of the projects we work on are water-related. Whether it is storm water, drinking water or waste water, water is a precious commodity and is related to health issues in the developing world," says Linda. "Standing water has malaria and dengue, storm water that damages homes and businesses. Water affects peoples' lives."

Wastewater is also an issue in developing countries. Dennis explains: "We have seen septic systems in schools where wastewater was on the ground and children would walk in it at recess. There were schools with several thousand students where they would flush the toilets once a week with a five-gallon bucket." Dennis' professional experiences include more than two decades of project engineering and project management. 13 years with wastewater conveyance and treatment.

One of the current Bolivian projects is a matadero, or slaughterhouse in the town of Colcapirhua. A mixture of blood, fat and water is drained into a hole and then pumped into a local river. The students have to test the water and engineer a solution not for U.S. standards, but one for which the Bolivians can pay for. Dennis explains in no uncertain terms: "It may not always be the best solution, but it is one they can implement because if they can't pay for it, I don't care what you design with, they aren't going to have anything. And something is better than nothing. That's awful hard for us to convey to the students."

Dennis and Linda make it clear they are not going to a third-world situation devoid of technology. "It's not like we are going to an area where people are uneducated and have no clue how to solve their problems. That's not the case at all. They have a good education system, they have good engineers, they have people who understand and can solve these problems. They just don't have the money," Dennis explains. The unique nature of this project lies in identifying the problem, creating a viable solution, and determining the cost. This is then presented to the locals, who in turn take the project and its costs to the appropriate government level. Because it is presented in a neat, professional package, the project gets the attention and hopefully the funding necessary to complete the project. If the government is not forthcoming with the funds, there have been many instances where the locals have taken the project into their own hands. Using the designs from the capstone students, parents and school organizations have built the projects themselves. While it may not have been their exact design, it is a testament to the students' careful drafting of proposals which take into consideration local culture, technology and the financial resources of the community.

Designing engineering projects in developing areas cannot be done with an industrialized mindset: in their projects, students consider the social ramifications of their work equivalent to their engineering standards. A project was designed to bring water closer to a village. Unfortunately, it reduced the local boys' interaction with the elderly residents for whom they fetched the water. Often the collection of water is women's work, and this work provides social interaction with other women. For us, being able to turn on a spigot is far more desirable than hauling buckets of water. But we get our social interaction in so many other ways. When the only chance to learn of illnesses in the village, of deaths and births, is removed, the damage to the social structure could possibly negate some benefits of engineering. What is most impressive to Linda are stories from alumni that tell how this experience impacts their engineering still today.

In addition to the slaughterhouse wastewater situation, current Bolivian projects include taming the rain season flooding in two towns not far from Cochabamba, one of the largest cities in Bolivia, situated at 9,000 feet in the Andes. In the town of Colcapirhua, a series of concrete canals overflow instead of properly channeling the water. In Tiquipaya a dry Riverbed turns into a torrent that has swept several school children to their death. This same flooding is undermining a new bridge that was built downstream with inadequate hydraulic protection.

To maximize the experience, Dennis limits the teams to three or four students while in-country. “Any more than that and you get sleepers in the project,” he notes wryly. “The students spend time at project sites gathering topographical data, water and soil tests, whatever they decide is necessary. They return to campus and do the feasibility study and the engineering report and then recommend a design to the customer. As our clients, the next step would be a presentation to them in Bolivia. Instead, we make a public presentation here in Florida. We skip going back, assuming that they will approve the project. Our next public presentation here will be April 10.” Family, friends, faculty and next year’s students are invited. Industry professionals and others are also encouraged to attend.

Linda requires her students to reflect on their experiences. Every one includes humorous, embarrassing or profound experiences. “Now that I am back and looking at my hometown, I notice the similarity of people; humanity of the world is so connected,” writes one student. Another student described the bridge design as “Helping the community in so many ways and I get to be a part of that and improve the lives of so many children. Now that is a great reason to become an engineer.” And one person who had never been outside of the United States wrote: “I may have spent a couple weeks in Bolivia in order to do my part, I was not the engineer but it is not the project that will make me a better engineer. It is the people that the project is for that will truly make me an effective and qualified engineer.”

Dennis observes that “One of the things that the students learn is that there is a different way of life there. Family, friendship, spending time together has more importance than having things. More important than having things, having stuff.” Bolivia is one of the poorest countries in South America. “We work in some of the poorest areas of the towns. When the students see the dirt floors and muddy roads, all due to a lack of money, that is part of the cultural education they take with them,” Linda adds. "The Bolivians have nothing, but they are a very giving people,” she continues. At the end of one project, a grateful villager entrusted every student with meager objects gathered from his home. “Keep them always, never give them away,” as he passed out a car-scent hanger, cheap jewelry and assorted objects from a brown paper bag. A Bolivian soccer player gives his third-place medal to a fellow soccer-playing student. Linda recalls that the astonished student sobbed. “These people have been kinder than anybody in the United States wrote: “I may have spent a couple weeks in Bolivia in order to do my part, I was not the engineer but it is not the project that will make me a better engineer. It is the people that the project is for that will truly make me an effective and qualified engineer.”

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The cost for each student is roughly $3,000. Both Linda and Dennis recognize that earning the money for this experience should come from the student. A handout is not always appreciated as much as the honest effort to earn something. But three thousand dollars is nothing for large engineering projects. When engineering firms present public-representations, “They see who shines. That’s a cheap investment for recruiting a future employee,” says Linda, “very cheap.” That may be so, but the benefit to the Bolivian people and the students is priceless.
Socially Aware Distributed Systems
by Janet Dawald

Dr. Adriana (Anda) Iamnitchi has received a five-year CAREER Award totaling $485,000 from the National Science Foundation to study the massive amount of social information data that flows through social networking and collaborative sites. She will use this information to design distributed systems where the users own their computers in the system. Sometimes referred to as “Web 2.0,” these systems are characterized by information sharing and a user–centered design, as opposed to servers providing static data from a centralized location onto client browsers.

An assistant professor of Computer Science and Engineering, Iamnitchi puts it more clearly, “It is not so much that you are male, age 25, love sushi, living in Florida that I care about, but about relationships you have with your friends, family and colleagues.” These relationships can be analyzed and used to help design and maintain intelligent, community-oriented, peer-to-peer systems. These systems are generally not administered by a central authority. The hardware is provided by the users who are free to download any application that will allow them to become part of that distributed network.

There are two major areas that generate this data, online social networks like Facebook and collaborative tools like CiteULike. Again, personal information is not the target, and a great amount of this study will delve into maintaining privacy issues. It is the information, freely generated by making friends on Facebook, or the act of tagging a scholarly article in CiteULike, that is at the core of the study. Facebook, for example, allows you to declare other users as friends. “The fact that you declare that a relationship exists, that is the information I care about. To say that you have a relationship with somebody means that there is some form of trust between you two. That is one of the most obvious social ties.” What if you have thousands of friends? “You cannot have meaningful relations with a thousand people, you don’t have enough hours in the day,” says Iamnitchi, “so we have to augment this information with other information. Of those thousands, with whom you communicate the most is important, for example.”

What if you add other information, such as information that can be collected from a typical cell phone? “Perhaps we can see that of your thousands of Facebook friends, you called a certain person twice last month. This person is more meaningful to you than the other people. So now we are trying to aggregate social information from reliable sources based on activity. You can even tag the activity to the location level. For example, if you are into hiking, you could label your activity on your cell phone. Using GPS-enabled cell phones to determine location is a common application now, you would just add another application to tag it and store it. Of course, you now have to make sure your cell phone has the proper set of privacy parameters, such as “Don’t track me in the city,” or “Only track me during work hours, from 9 a.m. to 5 p.m.”

But tracking you is not the only option. Distributed systems, with the appropriate software, can be used to track other people. Iamnitchi cites the example of the computer scientist Jim Gray. In January 2007, his boat was reported missing off the coast of San Francisco. There was no sign of wreckage and his emergency radio beacon never transmitted a distress signal. However, Jim had friends in high places—high technical places. DigitalGlobe, the map provider for Google Maps and Google Earth, put their best images of the San Francisco coast together with a collaborative Amazon application called the “Mechanical Turk.” The digital images were divided up between Jim Gray’s friends and colleagues. This social network downloaded the application and examined the images, discarding images that did not appear to be the ones Jim was disappearance. Jim Gray was never found, but Professor Iamnitchi uses this as an example of a social networking collaborative.

“This was done because Jim Gray was a very well-known person in a very technical field,” she explains. However, this kind of service...
could be available to anyone, using the systems she is designing on social information. Taken a step further, all mobile phones in a given area could be simultaneously contacted regarding a missing child, for example. Satellite images could be provided, and a host of searchers, who never leave their computers, could download an application to assist the people in the field. Another aspect of the project is collaborating with USF’s Department of Sociology in undergraduate and graduate courses. “All the students know how to use computers as tools. They don’t solve problems the way a computer scientist would,” Iamnitchi explains. “I think it is important for everybody to have deeper knowledge in computer science. Interdisciplinary studies are becoming more relevant for a well-balanced education. The computer science approach provides students with the opportunity to solve a problem by breaking it down into its smallest units, providing hands-on experience in problem-solving and logic. They don’t need to know how to write an operating system,” she adds, “but to think of a problem in terms of decomposing it and applying variables. This is becoming more and more important in the professional life.” She also would like to re-write the stereotype of the computer scientist. “We need a more diverse group, and by teaming up with sociology we hope to attract people who might have an interest in computer science, but do not know enough about the field to pursue it.” Did anyone anticipate the massive appeal of social sites and collaborative tools a decade ago? “No, we did not see it coming. Like the college student who developed Napster, he just wanted to share music. He did not mean for it to be a business,” explains Iamnitchi. “Look at Facebook, started by another student,” she adds. “Over 400 million people now use Facebook, started by undergraduates at Harvard. I think this is just human nature.” When asked about her favorite social networking sites, Professor Iamnitchi pauses. “I don’t have time for that!” But you can find her on Facebook and LinkedIn. Then she laughs, explaining “I had to do it for my research.”

drive less and make shorter trips. Yet most current impact fee systems charge the same rate in both situations. A variable rate based on vehicle miles of travel would reward developers who reduce the transportation problem by developing in urban areas.” The CUTR study also recommends that the legislature consider authorizing local governments to develop other concepts to help support operation of transit systems. “A one-time fee on new development is not sufficient to cover these continuing costs,” says Williams.

Another issue is how the impact fees are currently being expended. “Today, local government impact fees often do not go to transit agencies or the state, but these agencies are impacted by those same developments,” says Seggerman. “Also we see a lack of coordination even among jurisdictions in the same county on transportation issues.” To address these problems the study recommended a coordinated approach to mobility plans and fees or at least a countywide basis and a fee that could be expended on any transportation mode, not just roads. The study also proposed a more equitable distribution of the mobility fee among the jurisdictions and agencies impacted by new development.

A countywide mobility fee program in Florida would improve transportation and land use coordination and allow government agencies to share and expend the fees on transportation services and improvements to benefit both the local area and the broader region. Better sidewalks, bike lanes, carshare/rideshare programs, parallel routes, coordinated signals, network connections, regional and express transit service and even high speed rail could all be part of the solution.

Elting Mechanical Enterprises, Inc, Tampa, celebrates its third anniversary this year. The firm, started by Steve Elting (BSME ’99), provides machine design and mechanical simulation services in the areas of manufacturing, medical, and defense industries. Steve is the Vice Chairman of the American Society of Mechanical Engineers, FWCS.

Lauren Hunkins, sophomore in Computer Science & Engineering received a NASA MUST (Motivating Undergraduates in Science and Technology) scholarship.

Praveen Selkhar (EE PhD ’09) and Vishnuteja Nanduri (IMSE PhD ’09) were each recognized with 2008-09 Outstanding Dissertation awards from the USF Graduate School.

Nagesh Nayak, doctoral student in CEE was awarded a $10,000 stipend from Graduate Research Award Program on Public Sector Aviation Issues sponsored by the Federal Aviation Administration (FAA).

If being a College of Engineering student at USF is in the future of someone you know, plan a visit to our campus for an informative visit. During that visit, we can discuss opportunities including programs, curriculum, types of engineering fields, scholarships, student organizations, academic support services, undergraduate research opportunities, etc., within the College of Engineering. If you would like to find out more about our programs, visit us, or if you have any other questions or requests, please contact outreach@eng.usf.edu or (813) 974-0773.

We look forward to hearing from you!

Two EE doctoral students Frank Alexander, Jr. and Justin Boone were selected as National Science Foundation International Research & Education in Engineering (IREE) China program awardees.

Adriana Chacon, a senior ME student, was awarded first place in the engineering category for best oral presentation during the 17th Annual NSF Florida-Georgia Louis Stokes Alliance for Minority Participation (FGLSAMP) Career Expo.

The College of Engineering is accepting applications for full-time doctoral students for Fall 2010. The appointments include tuition waiver and full financial support for the academic year Fall 2010 and Spring 2011. The sponsorship is renewable annually and is contingent upon satisfactory progress toward degree objectives.

USF, a top research university, offers an intellectually challenging environment in a diverse student and faculty population.

http://www2.eng.usf.edu/phd2010

The 14th annual Bull-arney fundraising event sponsored by the Engineering Alumni Society was held March 27 at the Embassy Suites. The event raised approximately $20,000 for programs, scholarships and conference presentations for USF engineering students. Thanks to Saintly Sponsors Ash Engineering, Inc. and HSA Engineers & Scientists, as well as all the other sponsors and volunteers who made this event possible. All photos by Roger Cox.
A future engineer whose heart is in the right place
by Janet Dawald

Ana Roja

Ana Yasbel Roja is the President of the USF Engineering Expo. Majoring in chemical engineering, Ana moved from Lima, Peru with her family to Tampa, Florida when she was eleven years old. While attending middle school in the city, Ana recalls she attended a “great science fair.” She was amazed at the numbers and engineering exhibits. After graduating from Middleton High School and a few years later, she is now in charge of that “science fair,” the USF Engineering Expo.

“I remembered the fair, but forgot where it was,” Ana explains. Then, when her freshman advisor asked for some help and showed his students the location and layout, “I realized that this was the science fair of my memory. It was the Engineering Expo at the University of South Florida.” For the past four years she has helped the Expo, and for the last two years has been its president.

The February event draws over five thousand people from the USF area. For almost 40 years, the Expo targets middle school and high school students. Its primary purpose is to educate students on how math, science, engineering and technology affect our everyday lives.

Ana’s duties as Expo president involve coordination with staff members, professors, sponsors and exhibitors. Asked about her favorite exhibit, she replies “Since I have to help make sure things run well during the event, I don’t have an opportunity to see all of them.” Shepause, “but the Chemical Engineering Department puts on an impressive magic show with chemicals. The kids really liked that one and that is our main goal which is to encourage and teach students that engineering is fun and anyone who has passion and dedication can be an engineer.” With the presidential position comes diplomacy, and also responsibility for the tear-down when the Expo is over.

Ana will graduate this year with her major in chemical engineering. This past summer was spent at the University of California-San Diego (UCSD) researching an in-vitro method of probing the effects of substrate stiffness on stem cell-derived cardiomyocyte development. She is fascinated by the human heart, and has combined her love of mathematics with medicine to concentrate on coronary heart diseases. “The heart is an amazing organ. We are just starting to understand stem cells, and I want to do research that will find a way to cure heart disease without heart transplants.”

A member of the Engineering Honor Society Tau Beta Pi and a College of Engineering Honeywell Hispanic Scholar, Ana is also a participant in the NSF Florida-Georgia Louis Stokes Alliance for Minority Participation (FGLSAMP) and NSF S-STEM Scholarship programs. “They are both great programs,” says Ana. “They help you find research internships, provide scholarships and support your travel to present at conferences.”

“I recently presented at a national conference in Phoenix, Arizona and my next goal is to have an international research experience,” LSAMP’s goal is to increase the numbers of students from under-represented groups who obtain degrees in science, mathematics, engineering and technology disciplines. The S-STEM Scholars program, Engineering and Computer Science Scholars Targeted for Academic Retention and Success (E-STARS) at USF, is focused on providing retention support to financially needy students and assisting with their entry into the technical workforce or graduate school.

“I am very thankful for the opportunity to financially help students that engineering is fun and anyone who has passion and dedication can be an engineer.” With the presidential position comes diplomacy, and also responsibility for the tear-down when the Expo is over.

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Georgia Okeogbaa, professor of Industrial and Management Systems Engineering, has been elected to the Nigerian Academy of Engineering.

Autar Kaw, professor of Mechanical Engineering received the 2010 Outstanding Teacher Award from the southeastern Section of the American Society of Engineering Education.
Bringing our 19TH CENTURY POWER GRID into the 21st CENTURY

REAL-WORLD EXPERIENCE

Mitigating Pandemic Outbreaks — Research performed by IMSE professors could help minimize the spread of future pandemics

EAS Bull-arney — Civil Engineering students travel to Bolivia to work with local engineers on wastewater project

USF: UNSTOPPABLE
College of Engineering

Spring is here! As we enjoy warmer, longer days, our attention turns to new growth. For some, that means spring planting or cutting the grass. In the College of Engineering, we think similar thoughts but also look to commencement—that penultimate goal. It is a last “hoorah” for graduates, their fellow students, faculty, friends and family before embarking on a career.

Spring indeed brings thoughts of new growth and graduating seniors. It also brings to mind those of you that played a part in supporting the College, our professors and students—an integral role in the cycle of life and growth. Your gifts are part of the planting and nurturing process, without which commencement may not have been possible for some. We are grateful.

As commencement rolls around, this is your celebration too.

Speaking of celebrations, if you missed Bull-arney 2010, you missed a great event. Not just any party, Bull-arney features “celebrity” waiters such as Dean Wiencek, our Associate Deans, faculty, and prominent alumni—Jan Ash, Robert Garcia, Oliver Rodriguez and many others in zany costumes. Sandy Pettit, Engineering Alumni Society (EAS) Chair and her crew assembled a one-of-a-kind event to raise funds for EAS Scholarships and Programs in support of our students. I can’t thank them enough. A special word of appreciation is appropriate to acknowledge this year’s co-sponsors, Ash Engineering, Inc. and HSA Engineers and Scientists.

The EAS has demonstrated strong commitment and philanthropy under the guidance of Sandy Pettit, P.E. (’94). Through their primary fundraiser, Bull-arney, EAS has awarded more than $25,000 to our students for research presentations at conferences, to support student engineering society activities, student scholarships and to support Engineering EXPO! Congratulations and thanks to the EAS.

EAS Bull-arney
2010 Event
14 years of fundraising in zany costumes

As part of the UNSTOPPABLE campaign, Gene Balter, PE (’77), has agreed to serve the College as Campaign Cabinet Representative. Gene has been active in the College for many years serving as President-Elect and President/Chair of the EAS from 2005-2009. Gene currently serves on the USF Alumni Association Board of Directors. As Campaign Cabinet Representative, Gene interacts with Campaign leadership and other College Campaign Representatives. Gene will work with Dean Wiencek and the Development Office staff to share the UNSTOPPABLE message and opportunity with our many alumni and friends.

Gene strongly believes that before we ask others to give, we must lead by example. To that end, Gene and his son Daniel (’07) have announced the creation of the Balter Family Scholarship, which will support an undergraduate engineering student active in professional societies. Gene and Daniel are creating opportunities for undergraduate students through their generosity.

No matter how you support the College, your gift is extremely important in our life cycle. Your personal gift commitment ensures we are not only able to maintain, but grow. As our 2010 graduates set off on new career paths, thank you again for contributing to their success and ours.

We hope you enjoy watching the seeds you planted grow and flourish!