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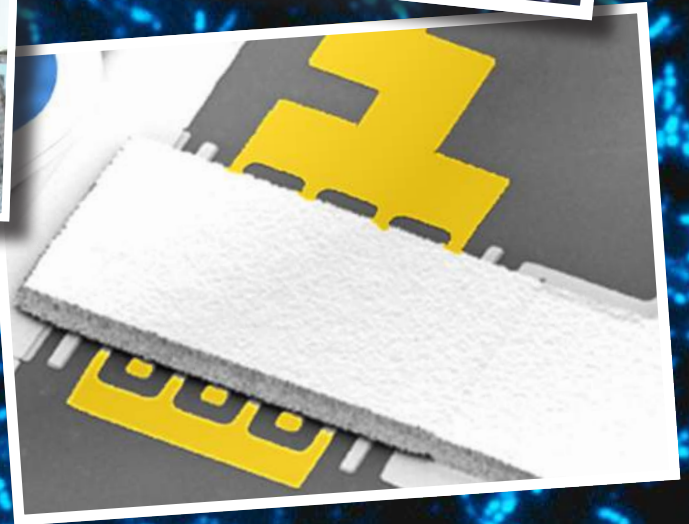
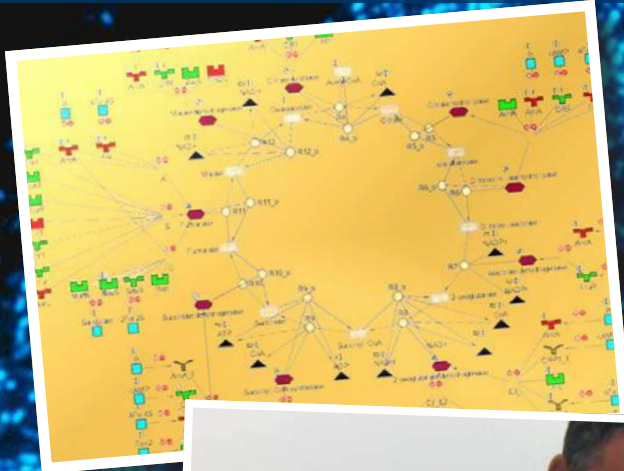
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CREATING Tomorrow

COLLEGE OF ENGINEERING 2010



**Engineered
Microstructures**

UtahStateUniversity

a message from the dean

H. Scott Hinton



Our College continues to improve by helping students secure meaningful internships. More than 80 students interned this summer and about half will carry that work into the school year. A number of companies offer scholarships along with internships, which helps our students immensely.

Employers continually praise our students. They have told us that our interns come ready to work and need little training before they are able to contribute to a project. They also tell us that our students work well within task groups and have excellent computer skills.

Conversely, students come back to campus with renewed excitement for their studies--or they start right then to modify their coursework to prepare them for a different internship the next year. Most find a niche that fits and, by graduation, are ready to compete very well in the market.

In the summer of 1963, President John F. Kennedy said: "We need men who can dream of things that never were." Creating tomorrow is what our enthusiastic faculty members and eager students are doing each day as they push what is known into what might be. We continue to progress, which helps ensure the best education and career opportunities for our students who will, indeed, create tomorrow.

H. Scott Hinton, Dean of the College of Engineering
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The College of Engineering at Utah State University is continually placing our focus on improved teaching, advancing research, and on enriching the learning experience for our students.

Two obvious results of that steady self-improvement are the Department of Mechanical and Aerospace Engineering being named the Top Department at the university in the 2009-2010 academic year, and biological engineering graduate Angela Dixon being named the 2010 Top Scholar university-wide.

In this 2010 issue of *Creating Tomorrow*, you will read about professors taking the pulse of aging bridges across America, students building a fish pond to supply sustainable protein to a Ugandan orphanage, about a student who has filed a patent for design work on a tethered arrow, and faculty studying students nationwide to find better ways to teach them.

You will read about young, local robotics whizzes who just need a foot up to gain international attention, and we give you an update on the Aggie Air Flying Circus commercial future. And, we're not without prize-winners in national and international competitions that bring honor and prestige to our programs.



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Cover images: Model of DNA sequence to create cell that generates a specific odor, using DNA 2.0, by BE graduate student, Angela Dixon, Dr. Charles Miller, Ecoli secreting bioplastic, MEMS Actuator, Dr. Bedri Cetiner and first David G. Sant Fellow, Xiaoyan Yuan.

Adventures in BIOLOGICAL Engineering

Engineering State gives high school juniors hands-on exposure to every field of engineering offered in the College of Engineering (COE) at USU. So, why not continue the experience that E-State started? That's exactly what the Biological Engineering Department has done for the past two years. Students who showed an interest in biological engineering were invited back to campus for a more in-depth experience.

Adventures in Biological Engineering (ABE) consists of three "field days" each summer, where interested students gain the knowledge and experience in order to make an informed decision about which direction to take their engineering careers in college.

More than 20 students, led by young, diverse and enthusiastic BE faculty members and graduate students attended this summer's ABE. Several of those had also attended E-State and are now enrolled in the BE program.

Day One introduced participants to the toolbox and skills needed to be a biological engineer and included hands-on lab sessions with biosensor-based instruments used in cancer research. They also created "bacterial art" by drawing with biologically engineered bacteria cells that produce different pigments. Both activities gave them a clear picture of the science that biological engineers use.

Day Two found students at the USU Algae Test & Evaluation Center at Logan City's wastewater lagoons, observing and

participating in algae research, from producing energy to devouring phosphorous in wastewater. A tutorial on producing biofuels from algae highlighted career opportunities in alternative energy and the continuing need for biological engineers.

On Day Three students explored the many medical applications of biological engineering from learning how microbes, cells, and DNA are currently engineered to developing new pharmaceuticals, tissue engineering and biomaterials for implants, and advanced medical equipment.

Graduate student Kirsten Sims and BE undergraduate biological engineering major Alex Hatch initiated a group discussion about the importance of ethics of biological engineering. Earlier in the year Hatch took first place in the 2010 Institute of Biological Engineering's national Bioethics Essay Contest with his essay "Four Suggestions for Addressing Public Concern Regarding Synthetic Biology." Sims took second with her essay "Development of a Cohesive Strategy to Effectively Incorporate the Concerns of the Public into the Development of Synthetic Biology."

Utah State's reputation for cutting-edge biological engineering research continues to attract prospective undergraduate and graduate students.

Registration for ABE is open to all former E-State students as well as incoming BE and general engineering students.

Adventures in Biological Engineering – just one of the many ways the Biological Engineering Department is engaging future Aggie engineers. ▣

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LEAPING THE iGEM MEDAL LADDER



The Department of Biological Engineering International Genetically Engineered Machines (iGEM) team climbed from Bronze to Gold status in just one year at the 2009 iGEM Jamboree held at MIT last fall. Their project and presentation, BioBricks without Borders: Investigating a Multi-host BioBrick Vector and Secretion of Cellular Products competed against entries from 100 teams representing four continents (29 from the USA). The gold medal is the highest award earned by any American team.

The team's goal was to "...develop improved production and harvesting methods of proteins and other products in multiple organisms using the standardized BioBrick system" by using biological parts from a synthetic biology kit designed specifically for the competition.

More specifically, to design a biological system to operate in living cells.

Two main foci of their research were to investigate broad host-range vectors for production of compounds in organisms other than *E. coli*, and develop a library of fusion-compatible BioBrick parts for targeting compounds for secretion, which they did both in the laboratory and at the conference table. They also cultured cyanobacteria, conducted the tri-parental mating procedure, coordinated the wiki, and prepared the presentation..

At the Jamboree, Sean Bedingfield (freshman), Alex Hatch (sophomore), and Cole Peterson (sophomore) presented. Other team members were Rachel Jackson (undergraduate), Junling Huo (doctoral student), graduate advisors Elisabeth Linton, Trent Mortensen, and Brad Henrie, and five high school students: Garrett Hinton, Jeff Karren, Jody Jerez, Hyan Jin Kim, and Tyrell Rupp. Dr. Charles Miller is the faculty advisor for the team, with support from Biological Engineering Department Head Ron Sims and College of Engineering Dean Scott Hinton.

"USU team members were able to interact for three days with students of similar interests from all over the world," Miller notes. "Besides an oral presentation, each team presented a poster. These poster sessions allowed an opportunity for interactions with other students including international students." □

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*The Gold Medal iGEM team from USU gathers at the MIT campus after competing against 100 teams from four continents.
Photo by iGEM, David Appleyard*



BIE becomes BE

The Irrigation Engineering Program has moved from the Biological and Irrigation Engineering Department (BIE) to the Civil and Environmental Engineering Department (CEE). As a result, BIE was renamed the Biological Engineering Department (BE) with final approval for the change given on March 26, 2010 by the USU Board of Trustees.

“Faculty members in both biological and irrigation engineering initiated the changes as a strategy to strengthen and better define both areas to external audiences,” says BE Department Head Ron Sims.”

Sims adds, “The name change reflects the emphasis of current and future research and coursework for the discovery and development of bio-products related to green energy, medicine and public health engineering, synthetic biological engineering, bioplastics, biosensors, and biomaterials.” Likewise, addition of the internationally recognized Irrigation Engineering Program to CEE adds value and strength in critical areas related to water resources planning and management. The result is a win-win for both departments.”

The BE Department’s new website, <http://www.be.usu.edu>, reflects the new areas of emphases at both undergraduate and graduate levels. □

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Essays take top honors

Biological engineering undergraduate

Alex Hatch and graduate student Kirsten Sims took top honors at the 2010 Institute of Biological Engineering National Conference. Hatch’s bioethics essay “Four Suggestions for Addressing Public Concern Regarding Synthetic Biology” won first place and has been published in the *Journal of Biological Engineering*. Sims took second place with her essay “Development of a Cohesive Strategy to Effectively Incorporate the Concerns of the Public Into the Development of Synthetic Biology.” □

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Invited by DOE to present at the 2010 Genomic Science Contractor-Grantee and Knowledgebase Workshop in Crystal City, VA earlier this year, were Dr. Charles Miller and graduate student Libbie Linton. The Department of Energy's invitation was extended based on the USU iGEM team's gold medal award at the 2009 iGEM competition at MIT, and on their bioplastics research that aligns with the missions of the DOE. Invited researchers were from Harvard, Lawrence Berkley National Labs, Cornell, and the J. Craig Venter Institute. Miller and Linton talked about biobricks without borders-- investigating a multi-host biobrick vector and secretion of cellular products. This annual DOE workshop brings together researchers supported by the Genomic Science program, representatives from the Department of Energy, and colleagues from other federal agencies. The program provides the foundation for biological solutions to address DOE mission challenges, including energy, environment, and climate. □

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Student Society Formed on Campus

Biological engineering students recently formed a student chapter of the Biomedical Engineering Society (BMES) at USU, with Dr. Soonjo Kwon as chapter advisor. The primary goal of BMES is to educate future professional leaders and prepare them for multidisciplinary research fields in biomedical engineering through publishing, collaboration, and a range of career-enhancing activities. Inaugural USU BMES officers, all biological engineering majors, are President Hemang Patel, Vice President Rena Baktur, Secretary Aaron Winder, and Treasurer Cody Gunnell. The chapter will hold regular meetings beginning fall 2010. □

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An All-Around Scholar

When Angela Burbank Dixon stepped onto the Utah State campus as a freshman in 2006, she had no idea that four years later she would be named the university's Scholar of the Year.

Dixon, a 2006 graduate of Woods Cross High School in Bountiful, Utah, said the environment in the College of Engineering is all about teamwork, which was stressed as a survival skill in her engineering classes. Teamwork is

what professional engineers expect as they work to solve real-world problems.

She acknowledges the importance of Dr. Timothy Taylor in getting her off on the right foot in biological engineering.

"He teaches the first class you ever take in biological engineering," she explains. "He wants to make sure you're thinking for yourself. If you can survive his class, you can survive anything."

In addition to a sterling grade point average, Dixon sports a commendable extracurricular

profile, which is part of the criteria for being named Scholar of the Year. She served as president of the Engineering Student Council, and was in charge of a very successful Engineering Week. In high school, Angela enjoyed tutoring peers and has continued to do so throughout her college career. Her ultimate goal is to teach engineering. Another extracurricular activity she enjoyed was meeting, dating, and marrying civil engineering student, James William Dixon III. □

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Camera Helps Lower Lab's Carbon Footprint

When researchers at the Utah Water Research Lab (UWRL) take on a project such as the spillway design presently set up in its Hydraulics Lab, as many as 40 individuals from private, government, or municipal organizations may be involved. Imagine the logistical headache getting even 20 people into Logan from various out-of-state locations, housed overnight, fed, shuttled to the lab, and returned to the airport every time water is being run through one of the physical models.

These concerns were alleviated six months ago when UWRL Research Assistant Professor Steve Barfuss and UWRL research engineer, Andrew Jensen, installed a high-resolution video camera on the ceiling of the laboratory with a bird's-eye view of the modeling floor below.

"Recent advances in software allow a client anywhere in the world to

operate this high-definition video camera," says Barfuss. The client can pan and zoom and rotate the camera 360 degrees.

"The University generously helped us set up the camera with its own website," Barfuss notes. "Our clients have access and control the 24/7 video camera."

"The camera works in low light, which allows us to turn off banks of fluorescent fixtures in the lab, and it records video, if one of our test sequences needs to be archived," Barfuss adds. Steve Barfuss and Bill Rahmeyer are principle investigators for the spillway model.

This model is part of a remediation project on Success Dam on the Tule River in the citrus growing center of California. The Corps of Engineers is working to bring the dam up to seismic standards, which requires the redesign of the spillway. Hence, the 1:20 physical model that fills most of



the 70 x 170-ft modeling laboratory floor.

Rahmeyer explains that the spillway must accommodate construction of the dam, including the possibility of floods, and address environmental and endangered species concerns, and the redesign of the highway bordering the dam and lake.

"Each time the model runs, we see adjustments to the shape and orientation of the spillway that will make it more hydraulically efficient and economically sound," Raymeyer says.

"There's a lot at stake in a project like this," Raymeyer stresses. "We're doing what's right for our clients involved with Success Dam and for Mother Nature. USU President Stan Albrecht has set a goal of drastically reducing USU's carbon footprint and we're part of the solution." □

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Irrigation Engineers Welcomed to CEE Department

The Irrigation Engineering program is now affiliated with the CEE department. The move was unanimously supported by CEE and irrigation faculty members--evidence of the close professional ties between the program, the CEE department and the UWRL.

The move completes a nearly 50-year full circle. Irrigation engineering split from civil engineering in the 1960s to become the Department of Agricultural and Irrigation Engineering, and later the Department of Biological and Irrigation Engineering.

Irrigation engineering has a storied history at USU, and has long been recognized as the best such program in the United States. Many prominent irrigation engineers in

the United States and globally are graduates of the USU program.

Faculty members continue a tradition of leadership in international development projects. Recent and current work spans the globe--from 10 countries in Latin America, to the Caribbean, Asia, Europe, the Middle East, and Africa, as well as statewide.

"CEE welcomes the irrigation engineering program and looks forward to a stronger and more productive collaboration with water-related divisions in the department, and with the UWRL," says CEE Department Head Bill Rahmeyer. □

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LONG-TERM BRIDGE PROJECT

As people in the United States age, so does the country's physical infrastructure. Case in point: its bridges. Bones and muscles deteriorate inside our bodies; metal girders and concrete deteriorate inside bridges. Doctors monitor the health of our bodies; engineers monitor the health of our bridges.

A team from CEE's Utah Transportation Center was selected by the Federal Highway Administration (FHWA) to work in tandem with experts from several universities and companies across the country to assess America's bridges through the Long-Term Bridge Performance (LTBP) program.

USU is in charge of monitoring and testing bridges in the western region of the United States. Dr. Marv Halling, principal investigator, is assisted by Dr. Paul Barr and Dr. Kevin Womack. Their focus is on two specific tests: live-load testing and dynamic testing.

Live-load testing consists of putting strain gauges and deflection measuring devices all over the bridge, then driving the equivalent of two loaded dump trucks onto the bridge in a controlled

environment with no other traffic.

This allows for strain measurements, said Halling. "By doing that, you can essentially determine the capacity, or help to determine the capacity of a bridge."

Equate dynamic testing to performing an EKG and taking the pulse of the bridge, Halling quips. He and his team use two shaking machines and vibration-measuring devices that shake the bridge, and measure the vibration.

So far, Halling and his team have tested three bridges--one in California, one in Utah, and one in Minnesota, and have done both live-load and dynamic tests on each. They are responsible for long-term instrumentation and monitoring for each of the bridges as long as the LTBP program lasts. USU is

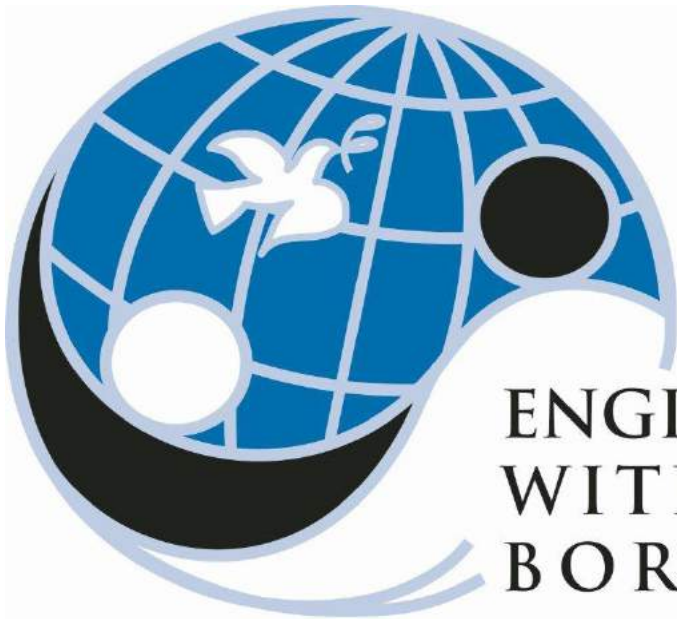
currently in its third year of a five-year contract. The program is anticipated to last 20 years, according to Halling.

LTBP is the result of renewed interest in revitalizing infrastructure across the nation, Halling notes.

"LTBP was conceived long before the collapse of the I-35W Bridge over the Mississippi river in Minneapolis in 2007," he explains. "The idea for this program is to give states a better methodology to take the limited money that they have and to apply it to the bridges that are most in need." □

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ENGINEERS WITHOUT BORDERS USA

Students and faculty advisors from the USU chapter of Engineers Without Borders traveled to Mexico, Peru, and Uganda to work alongside community members to implement sustainable engineering projects. The Mexico team evaluated water quality and quantity, conducted interviews with community members to assess their health and development priorities, and helped install several water cisterns in La Salitrera, Mexico. They will return to further evaluate the water distribution system, assess dry latrines, and provide education on water treatment and watershed protection in August 2011.

The Peru team evaluated water quality, inspected upgrades, provided technical advice regarding management of water supply and distribution systems and on irrigating effectively and extracting water from the irrigation canal, in four small rural communities in southern Peru. They will return in December 2010.

In Uganda the team designed and monitored construction of a lined pit for a new latrine, connected the school to the Internet, installed solar-powered wireless nodes and antennas, mounted extra solar panels on the roof of one of the dormitories for night-time lighting, assessed water flow and quality, tested the soil on an existing fish pond, and added one-thousand catfish fingerlings to the pond, which staff and students at the Byana Mary Hill orphanage near Masaka will maintain. Marketing the fish as they reach maturity may provide a source of income for the orphanage and a consistent source of protein for the children who only eat meat one day of the year - Christmas. □

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HAPPY TO BE HERE The EWB Uganda team at Byana Mary Hill orphanage in June 2010 (Top). SCRUB SCRUB EWB team member Betsy Ryan teaches Ugandan children about hand washing (Middle). CLEAN WATER Testing water quality from a drinking water well in southern Peru (Bottom).



USU Plays Pivotal Role in International Pact

Professors Robert Hill and Gary Merkley of USU's Irrigation Engineering Program have been working with the federal Millennium Challenge Corporation (MCC) over the past several years to provide technical assistance on agricultural irrigation development projects in Armenia, Burkina Faso, Cape Verde, and Moldova.

Earlier this year, Drs. Hill and Merkley attended the compact signing ceremony in Washington, D.C., for an MCC grant of \$262 million to the Republic of Moldova after more than two years of compact development and project preparations. The ceremony was held in the Benjamin Franklin room on the 8th floor of the State Department. The Prime Minister of Moldova, Vladimir Filat, represented his country, and Secretary of State Hillary Clinton (also the CEO of MCC) represented the United States. Following the ceremony, Hill and Merkley met with USDA officials to follow up on these and other projects.

"MCC officials indicated that Utah State University played a pivotal role in the work in Moldova, and that the irrigation management transfer design for the MCC project in that country is seen as a model for future MCC work in other countries," Merkley notes.

The Moldovan government asked Merkley to return in August to sit on their Technical Evaluation Panel and review proposals from international firms and consortiums hoping to implement the Irrigation Reform. The reform project will provide direct assistance to 11 irrigation systems, including infrastructure rehabilitation, river basin management,

organizational development and institutional strengthening of water users' entities, supporting legislation, and agricultural product marketing. □

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FINALIZING DETAILS Gary Merkley (center, looking at camera) meets with MCC and Moldovan officials, and a legal specialist from Belgium, in Spring 2009 in Chisinau, Moldova. The discussion was about finalizing the Irrigation Management Transfer design, and the complex technical, organizational, institutional, legal, and procedural aspects to it before the 2010 compact signing in Washington, D.C.



In Poker It's a Straight Flush

USU's civil and environmental engineering students drew a straight flush at the American Water Works Association Intermountain Section scholarship award ceremony this year. Of some 40 applicants from Utah and Idaho universities, USU's students drew five winners.

The AWWA Diversity Scholarship was presented to Oscar Marquina; Allia Abu-Ramaileh won AWWA's Undergraduate Scholarship, while Jon Farrell brought home the Graduate Scholarship from AWWA.

Andrew Hobson took the Water Environment Association of Utah Scholarship and Marquina doubled down by taking home the Air and Waste Management Association, Great Basin Chapter Scholarship. The students will spend their earnings continuing their studies at USU this fall. □



High-Resolution Synthetic Aperture Radar

Radar can be used to construct images of distant objects. Radar wavelength is about a thousand times larger than that of light. Using a radar to make a high-resolution image of an object that is, say, 20 miles away, the unbending laws of nature require the radar to have a mile-long antenna--an impossible size, especially since radar is often carried aboard an airplane.

The solution for making images with a radar is to use a small antenna, a fast airplane, and even faster electronics, says Jake Gunther. "This process is called synthetic aperture radar imaging (SAR)."

With SAR, an airborne radar emits a short but wide-band burst of electromagnetic energy which propagates to a distant scene and there reflects off objects of interest. These echoes return to the radar and are captured using high-speed acquisition electronics. Because light travels so quickly, all of this happens

before the airplane has had a chance to move more than a few inches. Then the whole process is repeated over and over again as the small radar antenna is quickly carried over a long track which effectively constructs the physically large aperture needed for high resolution images. What did I say about ingenuity?

Why go to all this trouble to use radar in the first place? Why not just use a telescope? How well does a telescope work at night, or in the rain, or in fog? Radar signals can penetrate not only darkness, rain, fog and clouds, they can also peer through foliage and can even see into shallow depths of soil. Thus, radars make it possible to take pictures in all weather and illumination conditions and they can see through trees and camouflage. Imagine a camera with these advantageous qualities.

Collecting the data is only one part of the image formation process. An

image of the raw data looks like random noise. The final step is to apply a focusing algorithm. These signal-processing algorithms convert raw data into recognizable images.

Drs. Jake Gunther and Todd Moon in the Electrical and Computer Engineering Department are researching new techniques for SAR imaging that overcome the limitations of existing algorithms which leave nasty obscuring artifacts in focused images. Their approach is based upon estimating the ground reflectivity in a mathematical model for the scene which includes characteristics of the emitted signal, the transmit and receive antenna beam patterns, receiver electronics, aircraft position and orientation across time, and a stochastic model for measurement noise.

Gunther and Moon attempt to exploit every piece of information available to deliver the highest possible image products. These images are used in a variety of areas ranging from optimal automatic target recognition and tracking to improved scene analysis for scientific and agricultural studies.

Gunther has been working on this project for about a year and a half and anticipates working on it for another 10 years. The project is being funded by the Space Dynamics Lab, and grants are being written seeking federal funds to continue the work. □

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miniSAR:DC3 and Helicopter Static Display -KAFB 4-inch resolution, 3.3 km range, 20050520, PASS001

NSF Support Keeps Robotic Work Rolling

Technology continues to push the limits of all electronic fields, none more than that used in self-directed, independent operating robots used in groups to accomplish sophisticated tasks. These are robots that communicate with other robots with little or no help or direction from humans and are able to go where angels fear to tread—not to mention police and fire officials, military personnel, and border patrol.

Dr. Wei Ren, principal investigator for three National Science Foundation (NSF) grants totaling nearly \$1 million, is working on three separate but connected projects, each with its own focus. The goal: to design distributed coordination and control strategies to enable unmanned vehicles or robots to work together without humans running them, even when those vehicles or robots can interact with only their local neighbors.

“Unmanned vehicles can do jobs that are too dangerous for humans,” Ren says. “They can monitor an area of high radioactivity and send back reports to humans.”

The research problems that Ren’s group are addressing include collaboration of heterogeneous teams of vehicles with different roles (for example, leaders or followers), multi-agent coordination under physical constraints or in complex environments, tracking of a dynamic target by multiple vehicles in the presence of reduced information flow and partial measurements, and coordination when the vehicles can only interact with their neighbors intermittently rather than continuously. □

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Supercomputers for Supercost

Supercomputers have been around for decades, some capable of running hundreds of programs simultaneously at more than 1000 times the speed of a conventional computer.

Dr. Koushik Chakraborty believes his answers to parallelizing sequential programs on Graphics Processor Units (GPU) will make a desktop supercomputer within reach of smaller-scale researchers. This supercomputer will be able to handle at least 10-25 percent of the work of today’s massive supercomputers for less than \$10,000 instead of millions of dollars, said Chakraborty.

“That’s pretty impressive,” exclaims Chakraborty. The low price of the desktop supercomputer will give more scientists the ability to do more work, much more quickly.

Chakraborty and his students have been working on the

desktop supercomputer for just under a year. Yiding Han, a graduate student working on the project, says one of the many applications possible on the desktop supercomputer is more high-definition video imaging. Chakraborty received support from the Utah Water Research Laboratory (UWRL) to conduct his research.

The technology will benefit ongoing research collaboration between the UWRL and the Electrical and Computer Engineering Department. One project, studying and tracking animal behavior in the Logan River area requires fine-tuning fluid dynamics algorithms. Chakraborty expects the project to be finished by the end of 2010.

In another project, supported through a USTAR program, Dr. Chakraborty and Dr. Sanghamitra Roy are developing high throughput algorithms for integrated circuit design. Using modern GPUs, they have demonstrated over 30X speedup over existing state-of-the-art techniques, and are currently pursuing avenues to patent their innovation. □

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Early Faculty Career Award



The National Science Foundation recognized the outstanding

potential of Dr. Chris Winstead's research by awarding him a 2010 Early Faculty Career Development Award (CAREER). The five-year, \$400,000 grant supports Winstead's research on wireless data communication for devices implanted inside the human body. The long-term goal of Winstead's research is to enable new technologies that can bypass damaged nerves. Sometimes the body's own communication circuits – the nerves – become damaged. Someday they may be replaced using wireless technology.

Among the more exciting implantable technologies are neural stimulators used to correct blindness caused by damage to a person's retinas or to the optic nerve. These devices use eyeglasses with embedded cameras that transmit information to stimulators that are surgically implanted in the brain, Winstead explains. "Clinical experiments have been able to restore some vision for a short time using this technique, but a major challenge is to transmit all the video data wirelessly into the brain.

"One of the problems is the fluid surrounding the brain. This fluid is basically salt water, which conducts electricity. The fluid acts like a shield that blocks wireless transmissions.

If you've ever taken your cell phone into an elevator, often times they stop working," Winstead explains. "It's the same kind of thing. The elevator is a big metal shield that reflects away much of the wireless signal energy. You can often still get reception, but you have a much weaker signal to work with."

"A second major challenge is the problem of heat. With modern wireless technology, it is no problem to download a video to your computer using a wireless network. But you'll notice that the computer gets hot when you do this. The cells in your body need to be at 98.6 degrees, but computer chips can often heat up above 120 degrees. We put fans in computers to cool them down. Obviously we don't want to put a fan in your brain, so we are exploring other ways to design very low-power chips that don't heat up."

Winning the CAREER Award places Winstead among a lofty corps of young scientists nationally who have used the generous grant to springboard their careers.

Winstead stressed that the award isn't given to professors because of things they've already achieved, rather for things they hope to achieve and how well that potential

is displayed in a written proposal.

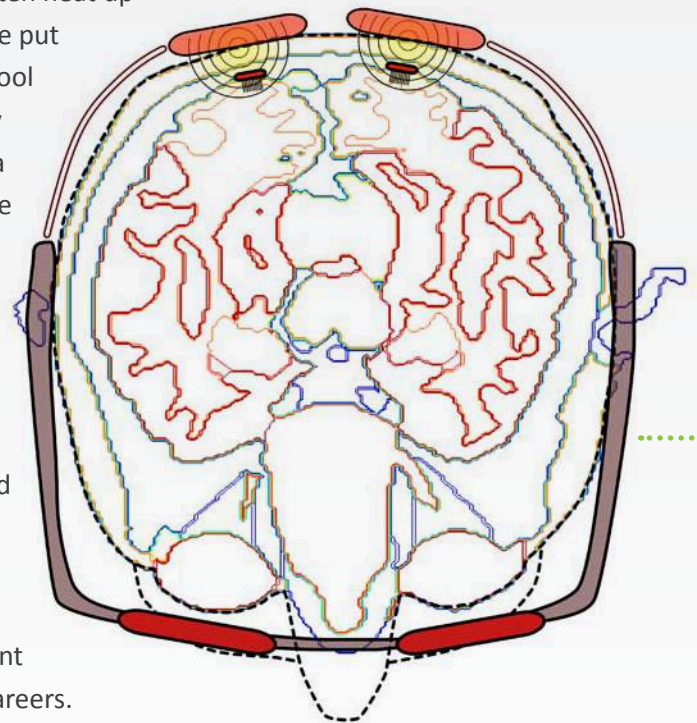
"Winning the award is amazing; it feels great to be in the club."

Winstead says with a smile. "The award is prestigious but not unattainable. With the right information and the right preparation, I would estimate that up to half of our assistant professors could win this award." □



Chris Winstead received NSF award to continue his wireless data communication research.

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In the classic cortical stimulator design, visual data is picked up by tiny cameras located on a pair of glasses. The data is transmitted into the brain's visual cortex located at the back of the head. Though this system was first imagined many years ago, the wireless communication need remains as a barrier before this idea can be realized.



It's All About Apps

Electrical engineering doctoral students Cal Coopmans and Yiding Han were part of an interdisciplinary team of USU students that walked away with second place in the software design category of Microsoft's Imagine Cup competition. The team's Facebook application, AidVenture, will enable Facebook users to select and invest in specific businesses seeking start-up financing. Once regulatory approval is secure, the application will begin connecting entrepreneurs with investors.

The idea of using social networks to facilitate the microlending process was the brainchild of Coopmans initially. Microsoft paid for 20 top student teams to travel to their Washington D.C. headquarters and present their ideas to a panel of experts at the Microsoft Imagine Cup.

Cal Coopmans shares a congratulatory knuckle bump with Microsoft's Chief Research Strategist Craig Mundie

Extraplaid, the USU team, included entrepreneurship economics and finance major Josh Light, economics and international business major Sterling Morris, and general education major Susanna Beck.

Craig Mundie, Chief Research Strategy Officer at Microsoft said "Imagine Cup is more than a software competition. "It's about inspiring students to become tomorrow's technology and business leaders. The technology industry not only is a key driver of economic growth and job creation,

but also offers vast potential to solvesome of the world's toughest societal problems. The creativity and passion of these students speaks volumes about the impact they will have on the world."

"This is going to be big," Han predicted. "It will only take us a few months to get it up and running. We believe it will help a lot of people and prove a good business model for us too." □

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How to think about thinking

What was I thinking? We've all asked this of ourselves after we solve a problem incorrectly, design a product with flaws, or grab the wrong tool for a repair. In research terms, we're asking ourselves to identify the cognitive steps that led to the wrong answer, approach, or result.

Professor and researcher Oenardi Lawanto asks the "meta"-question in his NSF-CCLI project "Promoting Metacognitive Knowledge and Shared Note-taking to Learn Electric Circuit Concepts through Enhanced Guided Notes": What is a person thinking as he or she thinks about a design problem? It's called meta-cognition and monitors the motivation, planning, analysis, and revising that goes into cognition.

Metacognition is implicated in the self-evaluation of one's knowledge and abilities, essential in any thinking activity. Research suggests that metacognition not only enhances learning outcomes, but also encourages students to be self-regulated learners who are metacognitively, motivationally, and behaviorally active participants in their own learning process. Research about metacognition is critical in instructional design. Studies suggest that with proper training, students can improve their control over learning and performance. "We don't teach students to think holistically," Lawanto says.

"We give them an assignment, be it to write a short story, design a better mousetrap, or laser-level a wheat field. In class, they learn how

others accomplished the assignment and what tools they used. But has he or she been taught to explore motivation, budget or special needs of the end-user?" "I believe this is especially true in engineering classes," Lawanto continues. Lawanto believes he will identify student cognition by piggybacking on 25 years of study by two Canadian researchers willing to collaborate with him in sharing their survey instruments and modifying their survey to focus on student metacognition in engineering.

Lawanto says this collaborative spirit opens a new avenue to study metacognition in engineering education more comprehensively, as multiple sources ensure validity of the data collected. Collectively they are looking at how to support self-regulated, strategic learning by students in classrooms and support settings, cognition, self-regulation, learning through reading, learning difficulties, and professional development at the intermediate, secondary, and post-secondary levels.

Armed with a better understanding of how students approach assignments, Lawanto believes engineering curricula can change to take advantage of how students think.

Collaborating with Lawanto on the NSF-CCLI project are ETE faculty member Paul Schreuders and Instruction Technology and Learning Sciences faculty member Doug Holton. □

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In What Way Do Students and Experts Think Differently



What differences are there in the way the following people design a neighborhood playground: a college freshman studying engineering, a senior engineering student, and an engineer with some years of experience, and a high school student with a predisposition to study engineering? (The answer is somewhere in this article.)

USU's Engineering and Technology Education team, in collaboration with Purdue University, has National Science Foundation funding to add the fourth group to the mix--the high school student.

"This three-year project will test the reasonableness of comparing high school student engineering design thinking with that of experts and investigate the feasibility of these research methods by addressing two research questions: 1) How does high school student engineering design thinking compare to that of experts in terms of performance and knowledge? and 2) Does student participation in a multiyear sequence of courses focused on engineering

correlate with changes in performance or design knowledge?" explains Dr. Kurt Becker, ECE Department Head, and principal investigator for the high school research.

"Finding and understanding the answers to these questions is critical to science, technology, engineering, and mathematics (STEM) education learning-- education," Becker says. "Can we change curriculum at the high school level to modify performance so students become interested in engineering as a career and become better engineering students in college? This will benefit engineering and society as a whole."

Will earlier exposure to STEM affect the way students gain expertise? Will early exposure create a stronger affinity for STEM subjects? Nathan Mentzer, project Co-PI, will collect some of the data intended to give insight into these questions. Mentzer came from public school teaching to USU where, as a Fellow at the National Center for Engineering and Technology Education (NCETE), he completed a doctoral program in curriculum and instruction and was a post-doctoral researcher at NCETE.

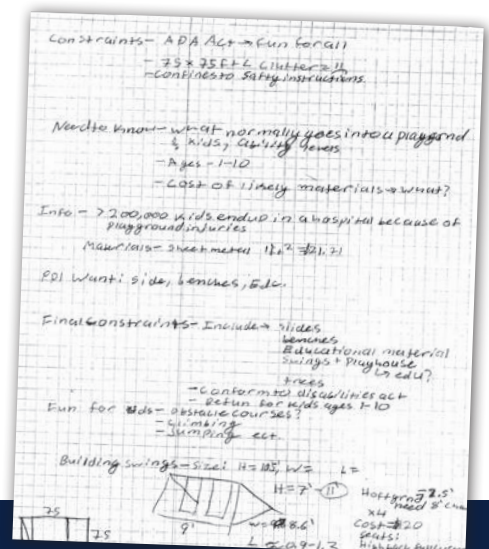
To compare the process of engineering design thinking, project researchers will use the very same design question that was used previously with college students and experts. Shown a lot diagram,

students are given criteria to consider in their design. The lot is 75' x 75' in a mid-size city, most children will be 1 to 10 years of age; 12 children should be kept busy at any one time; there should be at least three types of activity; and equipment should be safe, remain outside year-round, have a modest budget, and comply with the Americans with Disabilities Act.

"Past studies show that the engineering experts scoped the problem more effectively, gathered more information, covered more categories of information, and spent more time in all design stages," Becker says. In addition, college seniors produced similar quality solutions as experts.

Project researchers not only want to correlate their results with past data, but hope the information they accrue will show the way to improve curriculum design for introducing and attracting younger people to STEM subjects. □

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Looking for a Good Cause?

Motivating students to learn robotics and engineering design is a worthy cause--and pretty fun too!

Engineering and Technology Education Department faculty member Dr. Gary Stewardson and his students formed a design academy that brought sixth through twelfth graders from Utah and southern Idaho to the USU campus to build competitive robots. Their goal was to

prepare teams from that first design academy to compete in a regional VEX Robotics competition, and then to send winners on to the World VEX Robotics competition. To prepare, ETE sponsored the first Regional VEX Robotics competition held in Utah in January 2010.

The VEX World Championships is described as “three days of non-stop, pulse-pounding robotic challenges.”

Dr. Stewardson is responsible for getting the VEX competition up and running in Utah. Previously, teams had to travel as far as Seattle, Denver, or Las Vegas to participate in a regional

meet. Stewardson chose VEX because of its educational merits, and because “VEX is affordable and is the fastest growing robotics competition in the world,”

“We hosted eight Utah teams and one Idaho team at our regional meet,” Stewardson points out. “Judging by the feedback we’re receiving, we are planning for three regional competitions throughout the state and attracting about 16 teams.” □

For more details on the Design Academy and VEX Robotics, contact Stewardson, [gary.stewardson@usu.edu], 435-797-1802; or David Francis, 4-H Science and Technology Specialist, [dfrancis@ext.usu.edu], 801-292-1081.

Far Beyond the Classroom

When Andrew Deceuster finishes graduate work in USU’s College of Engineering, he’ll likely have a patent to go with his degree.

As a member of a research group for product engineering and rapid prototyping, Deceuster helped create five new products that are currently being marketed for a small specialty archery equipment manufacturer. He has a patent pending on one, and three additional products development.

“The people at USU have hit a home run for us,” says David White, owner and president of Cajun Archery and several related companies. “We just presented one of these new release mechanisms they designed at a national conference and, suddenly, we’ve gained a reputation as an innovative, high-tech company.

White says the biggest company in the business called recently to propose becoming partners on some projects. And, he says, the new products developed in cooperation with USU will bring new jobs to Cache Valley.

Heading the project development research group is Gary Stewardson, professor of Engineering Technology and Education. He says 90 percent of manufacturers in Utah employ fewer than 50 people.

“They certainly don’t have enough research staff to keep pace with global competitors,” he says. “We know from our one year with Cajun that we can help.

“And when we help, manufacturers benefit and jobs are created. That’s good for the economy,” he notes.

“But, from our standpoint, the greatest benefit is the opportunities we provide for students. From design to fast track prototyping to testing and manufacturing—they get to do it all.”



Deceuster, who is working on a doctorate in biological engineering, says the chance to work on a product from design to manufacturing has been a great opportunity for him.

“The design aspects have enhanced my education, but getting to be part of the entire operation with a real product has given me experience few students get,” says Deceuster. “Even many professional engineers pass off their designs and are never involved in the rest of the product development. I’ve been able to do it all and actually see the effect on David White’s business.”

It’s not everyone who grabs the opportunity to create real-world products while they are in school. With just a little luck, Deceuster will walk out with a Phd and a patent. □

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USU Aviation Club Soars on Terra Firma

Aviation students and their instructor, Larry Hemingway, climbed into two University vans and headed east to Peterson Air Force Base near Colorado Springs for a once-in-a-lifetime opportunity to train with the United States Air Force in a Hyperbaric Altitude Chamber.

Once on base and inside the Physiological Training Unit, each student was fitted with an oxygen helmet and mask.

Base Command taught concepts of oxygen system operations and equipment, altitude and environmental hazards, and other safety issues prevalent in Air Force flight accidents. One student commented this was a good summary of Hemingway's Human Factors and Safety class.

"The Chamber" resembled a propane tank cylinder, only ten times the diameter. There were 20 stations for participants with consoles containing intercoms and oxygen regulators. Each student learned how to operate the life-sustaining equipment and be-

gan the pre-breathing phase to reduce nitrogen in the bloodstream.

Air pressure began to decline to simulate conditions at 10,000 feet. After a return to sea-level to ensure that everyone tolerated the pressure change, the chamber supervisor began to reduce pressure again, this time to simulate an altitude of 25,000 feet. At this altitude, humans have just 3-5 minutes of useful consciousness.

Four Air Force Technicians outside the chamber observed the participants through windows, while three more monitored from inside. The head trainer talked them through every phase of the training.

One of the most important objectives of the training was so each could experience hypoxia (very low oxygen) and the symptoms that would lead to unconsciousness should oxygen systems fail. Half of the participants were instructed at one point, to remove their oxygen masks and complete a worksheet of simple math and other mental tasks. They were warned to be

aware of hypoxia symptoms and take the necessary corrective action, i.e. put on the oxygen mask and gang-load the regulator.

"I took this training as an Air Force pilot," Hemingway gratefully recalls, "and it saved my life when my pressurization system failed at 30,000 feet over Norway. There have been accidents where professional pilots crashed because they failed to recognize the effects of hypoxia. These nine pilots will be prepared for such an eventuality."

They returned to the Colorado Springs altitude with something they hadn't taken with them — professional and efficient training from the Air Force and an appreciation for altitude and the need to follow safety rules in all operations. Someday that training might just save one of their lives.

"We returned weary, but happy, and better prepared for an aviation career," quipped Brent Isaacs, a USU Aviation Club officer. □

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Nine USU aviation students pack into the Hyperbaric Altitude Chamber at Peterson AFB in Colorado to experience the effects of hypoxia. They are McKenzie Garn, Matthew Hinman, Brent Isaacs, Kizna King, Hollie Krumbule, Alex Loosle, Christopher Snyder, Mark Urruty, and Christopher Villarreal

USU Well-Positioned for Nuclear Energy Engineering



Utah State University, particularly the Department of Mechanical and Aerospace Engineering, has

amplified its national position in nuclear engineering research.

In just three years, MAE professors have won \$3.4 million in research dollars from various funding sources, including the Nuclear Regulatory Commission, the Department of Energy's Nuclear Energy University Program (NEUP), DOE National Scientific User Facility, and DOE Idaho National Laboratory (INL), reports Dr. Heng Ban, Associate Professor.

"We have solid support of university and college administrators," Ban

notes, "and from industry partners such as Energy Solutions, Advanced Manufacturing Engineering Technologies, Ceramtec, and INL."

"Some 10 MAE faculty members and 30 graduate and undergraduate students are either engaged in funded research or have written proposals in nuclear engineering areas such as thermophysical property measurements and instrumentation, thermal hydraulics, high-temperature materials, turbulence modeling, welding, materials constitutive model on radiation damage, and other nuclear-related topics," he continues.

This year, doctoral student Colby Jensen received a \$150,000, 3-year fellowship from DOE NEUP program—a very competitive fellowship, Ban points out. (Read more about Jensen

and his research at the bottom of this page.)

"Jensen, as well as the faculty, are competing very successfully against large, established nuclear engineering programs such as Texas A&M, University of Michigan, Purdue, and MIT," says Ban. "In addition to winning five undergraduate scholarships from the DOE NEUP program, 11 of our undergraduate students won \$12,000 per year scholarships from the Nuclear Regulatory Commission. We're right in there with those schools in terms of research, student scholarships, and fellowships."

Ban notes that the Department of Energy has begun to involve new university partners, including many (like USU) that currently have no official nuclear program. □

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In His Own Words

[Note: Colby Jensen won a \$150,000, 3-year fellowship from the DOE Nuclear Energy University Program

this year. He is presently completing his master's work while beginning to take doctoral coursework. Here is his reaction.]

Why do you think your application stood out?

A good academic record is a definite must. In the application essay, you need to show your interest and that you know what you're talking about—and that it's relevant. It also helps that I've worked on a project which contributes to the Next Generation Nuclear Plant (NGNP) program.

Certainly good reference letters are key and I had excellent help in that area.

How did you get interested in this field?

My interest in nuclear engineering research comes directly from Dr. Heng Ban. He has mentored and advised me; he's shown me the amazing opportunities that exist in the NE field.

What most interests you in the nuclear energy research field?

In Dr. Ban's lab, we are doing a lot of work to create systems to measure thermophysical properties of materials, an area in need of research for nuclear applications. We will be working with many state-of-the-art optical systems to do this. As part of this research, we require a better understanding of material behavior in

response to changes of temperature and irradiation.

Where do you see your career headed?

I believe that with this fellowship and the opportunities that Dr. Ban is stirring up, I can achieve a good, diverse Ph.D. training. One exciting prospect is to be able to travel to foreign and domestic labs to spend a few months doing research, meeting other researchers, and getting to know their facilities. We're planning a number of such collaborations over the next couple of years.

In the long run, I'll go where the greatest opportunity comes and where I can keep learning.

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New Aerospace Master's Program

With the first year of a new aerospace master's degree program under its belt, the Mechanical and Aerospace Engineering Department joins an elite group of almost 25 schools in the nation to offer this advanced degree.

The new program is the only one in Utah. Dr. Stephen (Tony) Whitmore is co-creator of the program along with Dr. David Geller. This is great news for COE undergraduates who want to pursue graduate studies at USU.

Geller says he expects the program to serve 6-10 aerospace master degree candidates at the outset, and add 2-3 students per year. The department hopes to offer a PhD in aerospace within a few years as well. Geller, Whitmore, and Dr. Rees Fullmer are the three key faculty members teaching the master's courses.

Whitmore says: "The first thing they look for is an aerospace engineering degree. Students that have that always get an initial preference."

Tyson Smith was one of the first students to earn the Master of Science in Aerospace Engineering. He

currently works at the Space Dynamics Lab's Missile Defense Space Experimentation Center in Colorado. "The courses that I took from the Aerospace Engineering Department at USU were what got me the job that I have today," Smith said. "While in the Aerospace master's program I had the opportunity to do some great research with Dr. Tony Whitmore, which I not only enjoyed but also led to a wide area of job options."

The program has a distance education component to it that allows students to take USU courses remotely. In the future, Geller hopes all of the classes will be offered through distance education. Some people have already taken distance education classes while at ATK, Hill Air Force Base, and even the Air Force Research Lab (AFRL) in Albuquerque, NM.

The second component for the degree is research, not required, but highly recommended. Students have the opportunity to conduct research for NASA, AFRL, and the Idaho National Lab, along with traditional course work. "You get something closer to the real world experience by doing the thesis research," Geller said. "To my mind, that's the big difference between coming out of school with an undergraduate degree and a graduate degree. With a master's degree you're probably more likely to be able to just jump in and start working." □

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Boiling Experiment at Microgravity a Success

Utah State University's Get Away Special "GAS" student team celebrated the success of a nucleate boiling experiment conducted in microgravity aboard a specially modified, NASA-contracted Boeing 727.

The student group was among 14 university teams awarded a coveted spot with NASA's Reduced Gravity Student Flight Opportunities Program, aka "Microgravity University; Vomit Comet."

USU's experiment, "Follow-up Nucleate Boiling On-flight Experiment" or builds on a previous experiment flown aboard Space Shuttle Endeavour in 2001.

2010 Goldwater Scholar Justin Koeln says "Nucleate boiling would be ideal

for thermal management systems, but its dynamics in microgravity are not well understood. If we can prove that boiling water in space is practical and safe, we're on our way to developing more efficient energy systems for long-duration space travel."

Providing robust, efficient and reliable thermal management for space exploration vehicles and instruments is essential for ambitious plans to travel to Mars and beyond.

"Our video from the on-flight experiment shows that the bubbles dispersed and didn't stay on the wire getting hotter and hotter," he said. "That's significant. It indicates how water boils without buoyancy, which could be revolutionary to manned space programs, satellites and deep

space probes."

Team members include Koeln, fellow flyers Andrew Fassmann, Troy Munro, Travyn Mapes, and Frank McCown; and ground crew Rob Barnett, Phil Anderson, Cameron Peterson, and Stephanie Peterson. Additional faculty advisors are Dr. Jan Sojka and Dr. JR Dennison from the Physics Department. □

USU students, from left, Frank McCown, Travyn Mapes, and Justin Koeln conduct a nucleate boiling experiment in zero gravity aboard a specially modified NASA jet.



Engineering Dream Class

Tim Auger's designs earned him recognition and awards his freshman year. Erik Stromberg was a freshman when he caught the professor's eye with his quick grasp of technology, creativity, and a determined work ethic.

If there is such a thing as an engineering dream class, MAE 1200 at USU is one. Students get the mechanical foundation—core skills and knowledge used in the engineering sciences—that they need to progress in their education and career.

They learn software that creates 3D designs, and then the assembly, sheet-metal design, motion, Finite Element Analysis, surfacing, geometric dimensioning and tolerancing, as well

as how to create a complete set of manufacturing drawings that conform to ASME standards. "Students have forced me to rethink simple concepts that had become so engrained over 20 years of working with CAD. They are willing to push the software in directions I hadn't conceived of. It took me a few years to figure out that the best ideas were actually in the students heads—not mine! That's a beautiful thing for a teacher.", says Adjunct Professor John Devitry.

Auger and Stromberg are two of those students. Auger's design appears in the 2010 Siemens Calendar alongside work done by professionals and companies that use Siemens' software. Siemens awarded him an HP mini 1030. A year earlier, he caught Siemens' eye in its students-only competition and his design was featured on the July

calendar page. That honor came along with an iPod. Stromberg has worked on the Dynamic Ionosphere Cubesat Experiment (DICE) project at SDL co-led by ECE faculty member, Charles Swenson. He took over the design of the satellite, specifically the scissorboom that extends equipment far enough away from the satellite to collect uncontaminated data. "Software basics are portable," Stromberg says. "Once you learn basics, you can switch to other software pretty easily. This synchronous technology lets you build, assess, back out, rebuild, and strengthen in real time. You know performance while you're designing."

Yes, engineering dream classes are real at USU, and MAE 1200 is one of them. Just ask Tim Auger and Erik Stromberg. □

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UTAH WATER RESEARCH LABORATORY

Largest Wastewater Lagoons Awash in "The Perfect Storm"

One of the largest wastewater treatment lagoon systems west of the Mississippi River is in the midst of a Perfect Storm, says Jeff Horsburgh, a Research Assistant Professor in Civil and Environmental Engineering at the Utah Water Research Laboratory (UWRL). Horsburgh and his colleagues are conducting intensive research on that storm, trying to gather information that will help federal and state agency, and local water treatment officials, calm the waters.

The lagoons in question are none other than Logan, Utah's "Square

Lakes," as Valley inhabitants drolly call them. As early as 2004, the Utah Division of Water Quality pointed to a state-funded study that showed levels of phosphorous released into Cutler Reservoir needed to be reduced by 50 percent. Too much phosphorus can create a habitat conducive to algae growth, which can remove oxygen needed by fish.

The required reduction in phosphorus loading has serious implications for Logan City's lagoons, which discharge to Cutler Reservoir and were not designed to remove phosphorus

from wastewater. Logan City officials have a plan for meeting phosphorus reductions required by the state, but are wrestling with the costs of implementing and maintaining the plan. The lagoons aren't the only culprits. There are other nonpoint sources of phosphorus upstream, such as erosion of phosphorus rich soils and runoff from agricultural operations. We know that there is a relatively high degree of uncertainty in the estimates of how much of the phosphorus entering Cutler Reservoir is from nonpoint sources. We are working to develop monitoring methods that will enable us to better quantify how much phosphorus is coming from nonpoint sources."

Horsburgh and the team of researchers at the UWRL are collecting data on phosphorous sources outside Logan's lagoons with funding from the National Science Foundation, Utah Water Research Laboratory, and Logan City. Using continuous water quality sensors, they are collecting daily, even half-hourly data from four major tributaries that flow into Cutler Reservoir's wetlands.

"We are using optical sensors that continuously monitor turbidity, or the clarity of the water, and from that information we can extrapolate the amount of suspended sediment and phosphorus in the water," Horsburgh explains. "Our research shows that there is a strong relationship between turbidity and concentrations of suspended solids and phosphorus. Because of that, we can create high-frequency estimates of phosphorus concentrations in the tributaries over the entire year that give us much better information about how and when phosphorus is moving into Cutler Reservoir."

"We can't manage what we can't measure" is a favorite maxim among UWRL researchers. "We must have accurate, detailed measurements", Horsburgh adds.

"These measurements provide good follow-up information to ensure that we are addressing all of the sources of phosphorus, and not just the point source," he continues. "We will also have better data for predicting what will happen to water quality as life in Cache Valley changes. For example, as our population grows and our agricultural lands transition to urban or residential lands, how will water use and water quality change?"

"It's really a perfect storm, where so many things are coming together to make this research exciting. Our research has a very practical and local application. We know that a water quality problem exists, but the people involved are willing to look at different strategies for addressing the problem.

Logan's mayor and city council members have searched for ways to save Logan City from state sanction.

An early candidate, one that could dramatically lower phosphorous discharges from the lagoons and pay for itself through the sale of biofuels manufactured from phosphorous-gobbling algae, is exciting, creative, and certainly adds to the perfect storm surrounding this issue, continues working on the project that, someday, may prove effective for Logan as well as small cities everywhere. □

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SENSING THE COLD Jeff Horsburgh cleans and calibrates one of the water quality sensors before returning it to the river.

AggieAir™ Ready to Go Commercial

In 2007, *Creating Tomorrow* introduced you to the technology driving the Aggie Air Force. In the 2009 issue, you explored the myriad applications for the tiny, precise, remote-controlled airplane packed with a high-tech camera, sensors, and communications equipment.

Now it's 2010, and the Aggie Air Force, in the form of a service center at the Utah Water Research Laboratory called the AggieAir Flying Circus,

continues its work on a rapidly growing range of applications. More importantly, its creators are deep into contractual work with the University's Technology Commercialization Office. The Aggie Air Force is trademarked to USU as AggieAir™.

"Over the past year AggieAir™ has moved several steps closer to launching a commercial venture and to move the results of this university research program to widespread

commercial application," reports Dr. Raymond DeVito, director of USU's Technology Commercialization Office. "Active negotiations are underway with three key players. An out-of-state university is negotiating a deal to bring AggieAir™ aircraft to their institution for local use. This would provide a second geographic focal point for operations of the AggieAir™ fleet. USU is involved in discussions with two Utah companies about

UTAH WATER RESEARCH LABORATORY

licensing for the manufacture and sales of the aircraft and services inherent to their use.”

Mac McKee, director of the USU UWRL has been working on structuring the commercialization plan. His assistant, Austin Jensen, was involved with the development of the AggieAir™ technology as an undergraduate and later as an MS student. Austin joined the staff at the UWRL as a research engineer and manager of the AggieAir Flying Circus. He supervises business conducted by the AggieAir Flying Circus and continues research and development of the AggieAir™ technology.

“The AggieAir™ platform has matured to a point where it is a viable data collection instrument. Though

its principal application now is the collection of aerial imagery. AggieAir™ has serious limits in the distance and elevation it can fly, and it cannot compete with conventional aerial services when large areas are to be photographed. Its strengths are its ease of deployment and its low cost in acquiring imagery of smaller areas that might not be cost-efficient for the deployment of conventional aircraft,” says McKee.

“Commercialization of university research provides an opportunity for the university to directly impact economic development as well as add to the general well being by enabling new products and services,” Devito stresses.

“USU is protecting the Intellectual

Patent applications have been filed and more are planned. □

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It has been a busy year for AggieAir. “Business is literally taking off,” McKee puns. “We have more requests for work than the team can accommodate.” The AggieAir Flying Circus now has contracts to obtain aerial imagery for research on a wide range of water resources problems including real-time irrigation system management, river corridor and riparian habitat, emergency flood response, road and highway facilities inventory and maintenance, and spread of invasive species in wetlands.



Then there were three...

When David Rosenberg was named the 2010 recipient of the prestigious Best PhD Dissertation in Water Policy and Socioeconomics by the Universities Council on Water Resources (UCOWR), he became the third professor at USU’s Utah Water Research Laboratory to hold the prize. He joins Laurie McNeill and Bethany Neilson, recipients of the award in 2001 and 2007, respectively, in the Natural Science and Engineering category. UCOWR consists of more than 90 international member universities and organizations that facilitate water-related research and education and promote, compile, and disseminate information on water problems and solutions.

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Hill AFB Project Completed

In the inaugural issue of *Creating Tomorrow*, published in Spring 2005, UWRL Civil and Environmental Engineer Ryan Dupont described the efforts his team was making to stop the spread of trichloroethylene (TCE) at a site on Hill Air Force Base. TCE is an industrial cleaning solvent that was used to degrease airplane parts and, prior to 1970, was disposed of in trenches on base.

Because the native soil didn't have the right geochemistry and microbial community to degrade TCE, the soil remained contaminated and plumes of TCE contaminated groundwater were bearing down on municipal water supplies and neighborhood backyards adjacent to the base.

UWRL's work on the clean-up effort started in 2001 with the challenge of finding the right combination of organisms and environmental conditions to detoxify the soil and groundwater. By 2003, eight 6-foot high columns filled with HAFB contaminated soil were well on their way to identifying Bachman Road (BR) bacteria as the TCE-loving organism of choice. Field tests in 2006 determined that BR would thrive in the HAFB soil.

The project ended this year, and the columns came tumbling down. The source area (Panel 5) of Operable Unit 2 where USU researchers applied their remedies, no longer contains

significant TCE levels and the source of TCE feeding the plume that was inching toward civilian communities has been removed.

One interesting finding among many is that whey (a complex carbon source abundant in northern Utah dairy country), when added to the soil mix, supports a variety of microbial reactions and actually protects the dechlorinators in the BR culture, and allowing them to continue working on TCE and its degradation products.

Research is far from finished, Dupont interjects. The contents of those columns will be studied to determine the interplay among all factors with an eye to putting together the most efficient, effective TCE remediation scheme possible. Microbiologists will study the ecology of the soil, looking for certain genes that code to various enzymes for degradation. They want to know if the distribution of bacteria differs in the natural setting versus columns fed different carbon sources.

Talks are underway for USU to begin remediation on several other TCE sources and plumes on base, and the UWRL research team is ready to grow large volumes of the BR culture and monitor their growth and progress toward site remediation using advanced molecular biology tools they developed in this project.

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USTAR funds 3 ENGINEERING PROJECTS

The governing authority for Utah Science Technology and Research (USTAR) awarded three of four 2010 Technology Commercialization Grants (TCG) this year to engineering faculty members Barton Smith, (MAE), and Koushik Chakraborty, Sanghamitra Roy, and Bedri Cetiner (all from ECE). Their research spans industrial coating markets, integrated circuit design, and wireless communication.

USTAR launched the TCG program in 2009 as a funding mechanism to bring innovative new technologies from Utah's public colleges and universities to the marketplace.

"The USTAR TCG program assists inventors and researchers in the final stages of idea implementation, and drives the commercialization of tech-

nology forward," explains Ray DeVito, Director of USU's Technology Commercialization Office. "The program also supports research projects that are most likely to generate patents, technology licenses, and product commercialization in the short term."

Smith's invention "Demonstration of Coanda-Assisted Spray Manipulation on Commercial Plasma Spray Guns" is a patent-pending device to control the direction and shape of thermal sprays with a high precision and rotation rate. The device would serve a \$7.6 billion market.

Chakraborty and Roy have developed a new concurrent floor planning algorithm that is 17 times faster than other floor planning tools. Floor planning is an important electronic design

automation (EDA) algorithm repeatedly used during the life cycle of an integrated circuit's design.

Cetiner's goal is to deliver high-reliability smart antennas by developing a water-level packaging technology along with highly reliable MEMS processes. Multifunctional, reconfigurable smart antennas are used in wireless communications applications to provide enhanced signal reception and transmission capabilities. Smart antenna technologies are a \$2 billion global market that Cetiner says "in the next few years will witness new technology standards that will have a direct impact on the adoption of smart antennas." □



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DEVELOPMENT *message*

The mission of the Utah State University development team is to do everything we can to find ways to improve, support, and strengthen the College of Engineering for the benefit of our exceptional students. Students - who come here for the best engineering education and training. Students - who will be the engineers of the future. Let me tell you what our development team has been doing to further our mission. We have worked to find ways to better our land-grant educational institution through outside funding opportunities in light of decreased state funding. We have worked with many generous USU alumni, friends of the university, corporations, and charitable foundations to set up new student scholarships.

Endowments have also been created to fund scholarships in perpetuity, to serve many students now and in the future. Funding has been obtained for student competitions and programs such as Engineering State, Engineers Without Borders, and the Society of Women

Rick L. & Anamarie Gold Endowment

“Ann and I both believe that higher education is extremely important in life and we are both privileged to have had the personal opportunity to attend and graduate from college. We think it is a very worthwhile endeavor to “give back” to a University that has played such a huge role in providing such a solid beginning in both personal and professional life. It is a great feeling to establish an endowment at Utah State University for deserving students in the College of Engineering.”



Rick is a 1968 Graduate of Utah State University College of Engineering and the former Regional Director of the Bureau of Reclamation in Salt Lake City. Anamarie is a University of Utah graduate and is the current Assistant Regional Director of the Bureau of Reclamation.

Engineers to name a few. Certain donations we receive allow us to build needed facilities and labs, such as the David G. Sant Engineering Innovation Building, the Hydraulics Modeling Laboratory, and the College of Engineering Structural Testing Laboratory.

Thank you for your help in assisting to educate and prepare the engineers of the future. We also welcome those who are interested in talking about the possibility of making a commitment to USU in the form of an estate gift to please contact me and we can discuss this option and how it may work for you and your estate planning. I would like to invite you to visit Utah State University and tour the campus. View the first rate facilities and observe progress being made for the future. Please contact me with any questions about the College of Engineering, and let me know if I can help you in any way. □

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The Loren R. & Mary Anderson Scholarship in Civil Engineering

“We are excited for the opportunity to establish the Loren R. and Mary Anderson scholarship in Civil Engineering. We love Utah State University and this is a lasting way of giving back to the institution that means so much to us. We met at Utah State



University in the spring of 1968 while we were students. Being Aggies has been a big part of our lives ever since. After spending six years in engineering education and engineering practice in California and Oregon, we returned to Logan and Loren joined the faculty in the Department of Civil and Environmental Engineering. We raised our children in Logan and we love all of the opportunities that USU offers to the community. As students, we were impressed with the dedication of the faculty and the commitment of USU to excellence in higher education. As faculty, we have been impressed with the students, specifically their sacrifices, their goal and their standards. Helping students is an investment in the future. Thanks USU. Go Aggies!”



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