DEPARTMENT OF ELECTRICAL ENGINEERING & COMPUTER SCIENCE

EECS NEWS



2011 University of Kansas



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Front Cover Image

EECS junior Emily Dellwig, team leader, Mechanical Engineering student Jeff Dickinson, and EECS seniors Tyler Danaver and Travis Bland stand with their hybrid vehicle. For the first time, the Jayhawk Motorsports team built and raced a hybrid race car, which finished in the top 10 at the Formula Hybrid International Competition.

Photo by Jill Hummels



PERSPECTIVE

n one of the most productive meetings of my career, the EECS Industry Advisory Board (IAB) set forth bold initiatives in recruitment, retention,



and curriculum in its spring meeting. IAB member **Brian McClendon** (BSEE '86) then pledged \$50,000 toward the purchase of computer tablets for incoming EECS students. The surprise giveaway this fall gained national and regional media attention for the Department.

Obviously, tablets help with recruiting. Additionally, we are pursuing different strategies, in conjunction with the School of Engineering, to bolster our enrollment. We are not immune to the national trend of decreasing enrollments in EECS programs.

The tablets prompted a retooling of our curriculum. IAB members urged the Department to incorporate more of a mobile computing focus. We are revamping our curriculum to focus on security, design, and other features that differentiate it from traditional computing.

Advisory Board Members (I to r) Robert Herrington, Kevin Wagner, Bob Chaney, Ted Batchman, Bert Soto, Scott Francis, Phil Anderson, Brian Ruf, Mitchell Trope, Cyndi Anschutz, Brian McClendon, and Craig Sparks met at the Adams Alumni Center in April.

Industry Advisory Board members and faculty discussed how the Department can help EECS students succeed. The group recommended a New Student Seminar that would highlight Departmental resources and requirements, feature possible career paths, and connect students with their classmates. I am still not sure how EECS Professor **David Petr** pulled the seminar together for the fall, but he did it with tremendous success.

In a previous IAB meeting, members suggested expanding our degree options to draw a broader range of students. The undergraduate Interdisciplinary Computing program, launched this fall, specializes in computer science and one of five fields of study: astronomy, biology, chemistry, geography, or physics. Students will learn how to build computational tools and applications that best meet the needs of their second field of study. EECS Professor Arvin Agah, who led the approval process through the Board of Regents, has said many times that students want to have a direct impact on real-world challenges. The IC degree gives students a great avenue to do this.

We had another IAB meeting in November to present a status report on the initiatives set forth in the spring and to begin updating the five-year strategic plan for the Department. I am incredibly grateful to our IAB members for taking time out of their busy schedules to help EECS grow and build upon its current success.

The following pages highlight the incredible year we have had in 2011. EECS students and faculty have achieved national recognition for their efforts. We have another W.T. Kemper Fellowship for Teaching Excellence winner and multiple students who have earned National Science Foundation fellowships. Our featured alumnus is using his skills and knowledge to build an IT infrastructure in his home nation of Bhutan.

Thank you for your continued support of EECS. I can't wait to see what 2012 brings us.





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Alumnus Surprises Students with Tablets

t was anything but a typical Monday morning class for students in Programming I. Their Sept. 12 class, which was moved to the Spahr classroom, had a host of reporters and dignitaries in attendance. While this could partly be explained by their guest speaker,

Vice President of Google Maps and Earth Brian McClendon (BSEE '86), students did wonder.

The first-year EECS students were soon let in on the



surprise. McClendon and his wife, Beth Ellyn, personally donated \$50,000 to KU Endowment for the purchase of Android[™]based tablets for EECS freshmen. Much more than a cool gift, the tablets are a tool to spark creativity and entrepreneurship.

"At first I thought our professor was being honored, but then Brian made the big announcement and my jaw hit the floor," said EECS freshman Reid Zimmerman, who gasped at the news. "I don't think there were any words at first; just shock. I remember thinking that it was an Oprah moment, and that this kind of thing never happened to me. It dawned on me then how special this program is."

"This opportunity has left me thrilled and excited to be a part of such a great program where the possibilities are limitless," said EECS freshman Amanda Parks.

The tablets provide EECS students with unprecedented programming and development experience with the world's fastest-growing mobile platform. It's all part of a plan to ensure KU students gain practical experience with leading-edge technologies.

"I believe future engineers need be prepared to jump into a job when they graduate and, for many, this means

Top Photo: (I to r) EECS freshmen Shannon Bisges, Amanda Parks, and Jordan Callison examine their new computer tablets. Inset Photo: Vice President of Google Maps and Earth Brian McClendon (BSEE '86) talks to students about mobile computing.

K

they will need to be well-versed in programming for future mobile computing," said McClendon. "Lowcost smartphones and tablets are revolutionizing the world's access to information, and they need to be ready."

Eighty-nine students were enrolled this fall in the required Programming I class,

and those taking the introductory course in the spring will receive the Motorola Xoom tablets. Students will be expected to use them in coursework over the next two years, but are encouraged to use them for enjoyment as well as their own professional

into multiple courses, focusing on security, design, and other features that differentiate tablets from traditional computers.

The tablets will make course lessons much more interactive, said EECS Assistant Professor **Bo Luo**, the other instructor for Programming I. Instead of reading

"I don't think there were any words at first, just shock. I remember thinking that it was an Oprah moment, and that this kind of thing never happened to me. It dawned on me then how special this program is."

-EECS freshman Reid Zimmerman

development. Students must receive at least a C in the course and remain an EECS major to keep the tablet.

EECS Assistant Professor Brian

Potetz, who teaches one section of Programming I, said the Department would be integrating mobile computing on a Powerpoint slide, professors can open and highlight code. With everyone having the same device, it becomes easier for professors to lead in-class programming exercises.

squashed code

"We believe that mobile computers

provide an outstanding platform to enliven the learning process without sacrificing fundamentals," said Dr. Potetz.

By developing simplified versions of Android programming capabilities, Drs. Potetz and Luo hope to give students a feel for what they will be able to do. For example, they have developed a photo manipulation exercise that takes advantage of tablet's camera feature to teach basic programming.

Prior to the gift, Parks had not owned a tablet. She has been surprised by how many things she could do on it. She says it has almost all the capabilities of a laptop but is much more convenient. It has been a great learning experience inside and outside of the classroom.

Zimmerman had not owned a tablet either but says he can't imagine life without it now.

"I truly love my tablet, not romantically of course, but more like a captain loves his ship," joked Zimmerman, who has named his tablet Nova.

Because the tablet computer giveaway would move course content in a new direction, the plan has been in the works and under wraps for several months.

During the EECS Industry Advisory Board meeting in April, McClendon challenged the Department to find new ways to recruit and retain students. He proposed the giveaway, and the Lawrence Motorola office provided a discount on the tablets.

Did You Know?

Google has donated \$50,000 toward the purchase of Android[™]-based computer tablets for the 2012-13 year, allowing incoming EECS freshmen to receive brand-new tablets for the second consecutive year. With over 200 million Android devices around the world, the donation gives students early and unique programming and development experience on the fastest growing mobile platform.



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New Student Seminar Offers Guidance, Resources

t is easy to become overwhelmed by the newness of it all—new school, new program, new people—and start to feel lost among the thousands of KU students. To make the transition easier and more successful for students, the Department has created the New Student Seminar that highlights Departmental resources, requirements and possible career paths and connects students with their classmates.

EECS Chair **Glenn Prescott** says the seminar came out of the EECS Advisory Board spring meeting. Board members challenged EECS to find innovative ways to recruit and retain students. While demand continues to rise for EECS professionals, enrollment, at KU and across the nation, has not kept pace.

The seminar helped the 159 new EECS students connect with those in the Department and begin to feel like they belong in EECS. Icebreakers and other get-to-know-you activities were staples of the seminar, allowing students to start forming bonds that will help them succeed in the program.

EECS Associate Chair for Undergraduate Studies **David Petr** was in charge of the seminar. He led students through the curriculum of each major and brought in recent alumni to discuss their EECS experience and career. Along with traditional careers, Dr. Petr invited alumni who had taken more unusual career paths to show students the breadth of opportunities. Additionally, advising, course substitutions, and other common situations were discussed. EECS freshman **David Menager** enjoyed the guest speakers, especially **Brian McClendon**, vice president of Google Maps and Earth, who discussed abstractions, and EECS Assistant Professor **Brian Potetz,** who described his work in computer vision that renders 3D images from 2D pictures. The seminar also provided students with information about important resources, such as tutoring.

"The seminar helped to relieve some of the pressure by letting us know about opportunities for help. It was not the only reminder, but it definitely helped," said Menager.

Student coordinators, EECS juniors **Michael Albert, Chris Hudson**, and **Jalashree Mehta**, provided ideas for and organized activities, including the popular Upperclass Facetime segments. The coordinators divided the class into small groups and then arranged for upperclassmen to talk to and answer questions from each group.

"I think the seminar helps students gain some direction, pretty early on, about the available areas that they could get involved with," said Mehta. "The fun activities help students get to know one another. The seminar prepares the students for their journey within EECS."

In addition to regular interactions with current students and alumni, Dr. Petr organized multiple faculty meetings. Professors discussed their research interests during guest lectures. They met with students during a pizza party in





Top Picture: EECS Professor Gary Minden answers students' questions during the pizza party/meet and greet in August.

Nima Tshering (BSEE '02) talked about his EECS experience during a New Student Seminar class this fall. He stayed after to answer questions, including one from EECS junior Jalashree Mehta (left).

Locke Atrium. If students talked to at least three professors and had them sign a card, they received an EECS water bottle. More than 40 students took home water bottles.

For Dr. Petr, the most telling figure was 45 percent. Every student could miss two classes without a penalty, but nearly half the class missed less than two times. Dr. Petr believes this signals the seminar is on the right course.



Interdisciplinary Computing Degree is First in Big 12

By Cody Howard & Michelle Ward

he new Bachelor of Science in Interdisciplinary Computing (BSIC) provides students with expertise in computer science and one of five fields of study: astronomy, biology, chemistry, geography, or physics. BSIC graduates will be able to tailor computational tools and applications to meet the specific needs of that field.

"This puts computing within a context and can attract students interested in interdisciplinary studies," said EECS Professor **Arvin Agah**, who led the approval process. "Studies show offering computing within a context appeals to those who seek real-world relevance in their studies."

While the skills of computer scientists are in high demand, Dr. Agah says companies encounter a common hurdle.

"We see a lot people hiring computer scientists to write code for them to achieve what they want in their area, but then they have to teach them chemistry, physics or astronomy, whatever the specialized area is," said Dr. Agah.

EECS faculty are working closely with faculty from each partner discipline on the curriculum. Programs can be added as more interdisciplinary partnerships are formed on campus.

"We are proud of the partnerships formed to make this [BSIC degree] possible and look forward to expanding this degree program in the future to ensure our students are ready to meet the challenges of tomorrow," said Dean of Engineering **Stuart Bell**.

KU is one of just a handful of universities in the nation and the first in the Big 12 Conference to offer a IC degree. The new program is expected to expand the appeal of computer science and draw a broader range of students into the field.

"The bottom line is, people don't want to just write code to be writing code," said Dr. Agah.
"People want to write code that can have a direct impact in addressing challenges we face in the real world."

This fall EECS junior **Grant Hays** became the first student to major in BSIC. While his physics courses fascinated Hays, he was not sure how he could blend physics with his then computer science major. The BSIC program gives Hays the ability to develop simulations, models, and other computational tools for complex problems in physics.

"When I read about the introduction of interdisciplinary computing, I was really



EECS junior Grant Hays submits a change of major form to Charlotte Talley in the School of Engineering (SoE) Dean's Office, becoming the first student in the new Interdisciplinary Computing program. (I to r) SoE Associate Dean for Undergraduate Studies Robert Sorem, EECS Chair Glenn Prescott, and EECS Professor Arivn Agah, who led the BSIC approval process, stand behind Talley.

excited. It was the perfect balance of computer science and physics," said Hays.

In following a directive from Kansas Board of Regents, no new faculty positions or resources will be needed for the BSIC degree program.

"People want to write code that can have a direct impact in addressing challenges we face in the real world."

— EECS Professor Arvin Agah



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Distinguished Professor Directs Graduate Programs

an F. Servey Distinguished Professor of EECS Victor Frost became the new Associate Chair for EECS Graduate Studies this summer, replacing EECS Associate Professor Man Kong who served in an interim role.

Dr. Frost has chaired 12 Ph.D. dissertations and more than 69 graduate MS theses. He helps students strengthen their critical thinking and writing skills to better prepare them for their careers, says **Daniel Fokum** (Ph.D. CS '10), who now teaches computing at the University of the West Indies. He adds that Dr. Frost's prominence in the simulation/networking community, which is why Fokum came to KU, will bring even greater visibility to the EECS graduate programs.

"Over the next few years, our goal is to grow the number of graduate students



while increasing the quality of EECS graduate education," says Dr. Frost. "We are preparing our graduates to be the future leaders and drivers of new technologies and innovation."

Recently, Dr. Frost completed a two-year program directorship in the Computer and Information Science and Engineering Directorate at the National Science Foundation, where he helped set the national research agenda for networks. A Fellow of IEEE, Dr. Frost and his graduate students have contributed to the design and analysis of communications networks; that is, the technology that supports the Internet. He has served as principal or co-investigator on more than 80 projects. Dr. Frost served as the director of KU's Information and Telecommunication Technology Center for 11 years, before stepping down in 2008.

"Victor is one of the best teachers and scholars in our Department. He has the trust of the faculty and he is an excellent role model for our graduate students," says EECS Chair **Glenn Prescott**. "His experience as a researcher, NSF program manager, and research center director makes him an ideal Associate Chair."

Change in Guard: Longtime Office Manager Retires



ECS Office Manager **Cindy Wallis** had been thinking about her

retirement party for quite some time before the June event. With ample planning time,



she decided she would like the Oscar Mayer Weinermobile to transport her down Jayhawk Boulevard with a band following her and playing "When the Saints Go Marching In." EECS staff pulled off a scaled-down version of Wallis' envisioned retirement party with a Weinermobile cake and a jazz quartet. Numerous friends and colleagues from her 30 years at KU filled the Locke Atrium of Eaton Hall on June 10.

Wallis plans on traveling, directing home renovations, and spending time with Moe, the wonder dog, and the rest of her family in retirement.

Elizabeth Dracobly replaced Wallis as Office Manager in May. She oversees the

Department's finances, human resources, ordering, policies, and numerous other duties.

Dracobly came to EECS via KU's Instructional Development and Support Department,



where she maintained purchasing, invoicing, and other budgetary and personnel records.



Seniors Find EECS Shop Becomes 'Best Friend'

he Navy veteran Tom Colwell runs the EECS Shop with precision and order. More than 300 drawers filled with resistors, capacitors, and other components are all neatly marked. The nearly floor-to-ceiling shelving in the front room also houses larger tools that each have their assigned spots. Orderliness, says Colwell, is necessary with six students rotating at the front desk. If Shop attendants had to go rummaging for parts every time, there would be a lot of unhappy students, says Colwell. He wants the Shop to run efficiently as possible to assist often stressed-out students in the middle of projects.

Located on the third floor of Eaton Hall, the EECS Shop is near the Senior Design Labs. As seniors design, build, and analyze real-world systems, they often go to the Shop for guidance.

"The EECS Shop becomes your best friend during senior year," says **Tom Willger** (BSEE '11), now a Test System Engineer at Texas Instruments. "When building your first independent circuits, there is a cruel debugging phase to achieve a fully functional circuit. Tom Colwell is the man to talk to when you need assistance. After a long night of unsuccessful debugging, Tom's words are as precious as gold."

Each year Colwell and his staff fabricate hundreds of printed circuit boards, saving thousands of dollars in outsourcing costs. In-house milling ensures a quick turn-around of precise fabricated boards needed to operate electronic devices. In addition to etching, milling, and other fabrication work, attendants order parts for senior design projects and prepare



EECS junior Robert Perez runs the milling machine in the EECS Shop.

kits for lower-level EE and CoE labs as requested by graduate teaching assistants (GTAs).

As a GTA for the Senior Design Lab last spring, EECS doctoral student **Matt Cook** worked closely with Shop personnel to ensure students had the necessary equipment. A few years earlier during his own Senior Design course, EECS Shop technicians helped Cook's team build a canned satellite containing sensors, a microcomputer, and a radio to send collected data.

"During my Senior Design class, the EECS Shop went above and beyond to accommodate my team in getting the components and tools that we needed to meet deadlines and complete the project," said Cook. "Then as a TA for Senior Design, I worked one-on-one with the top-notch EECS shop staff to plan and organize for the Senior Design class. I look back fondly at my experiences with Tom Colwell and EECS Shop staff."

"If students need something, they just have to walk down the hall and ask. The Shop usually has it," says EECS graduate student **Matt Kitchen**, a current GTA for the Senior Design Lab. "The shop not only provides components and test equipment but also offers solutions for prototyping circuits, such as printing and milling circuit boards. People in the shop are always knowledgeable about circuit fabrication and can offer plenty of helpful advice."



New Faculty

Experts in Data Privacy, Wireless Comms Join EECS

ECS Assistant Professor **Fengjun** Li is developing cryptography techniques that enable

organizations to share data while maintaining user privacy. As electronic medical records, smart grids, and other massive systems collect and



store unprecedented personal data in the name of greater efficiency, reliability, and cost savings, how will individual privacy be protected?

For example, a smart grid collects data every few minutes. The information allows energy producers and users to make more informed decisions, but it also shows when a customer gets up, does laundry, goes online, leaves the house, and so on. Patterns emerge, such as when the house is vacant, that pose additional security concerns.

Dr. Li has developed an innovative innetwork aggregation approach to data collection. Instead of sending data directly to collector devices, smart meters form multi-hop routes via other smart meters. Nodes along the way aggregate the received data with its own and forward the results to collector devices. Data aggregation spreads the operations and the computational efforts originally at collector devices into sets of nodes, greatly reducing network traffic. The approach cuts the network load by more than 60 percent. For additional security, Dr. Li employs homomorphic encryption. Household data are protected not only at intermediate nodes but also at the collector devices.

This fall she taught Advanced Topics in Information Security (EECS 700). The graduate-level course covered security concepts, cryptography primitives, authentication, and other emerging topics. She will teach Network Security (EECS 712) this spring.

Dr. Li received her Ph.D. in Information Sciences and Technology from the Pennsylvania State University in 2010.

EECS Assistant Professor **Lingjia Liu** is developing technologies that will enable future wireless networks to support heavy traffic, while providing reliable and secure

service for time-sensitive and dataintensive applications, such as streaming video and web conferencing.

His research focuses on

inter-cell interference mitigation and delay-sensitive and energy-efficient wireless communication. Dr. Liu's work aims to increase the overall spectral efficiency to support more users and applications. From smartphones and computer tablets to Blu-ray players and e-book readers, millions of devices are gobbling up the radio frequency spectrum. Greater efficiency is needed.

This fall Dr. Liu taught Wireless Communication Systems (EECS 865) with EECS Distinguished Professor **Sam Shanmugan**. In the spring, he will teach Estimation and Detection Theory (EECS 965). The course will introduce students to fundamental concepts in statistical signal processing along with their applications to electrical and computer engineering.

Dr. Liu has made numerous technical contributions to major wireless standards, including 3GPP LTE/LTE-Advanced and IEEE 802.16m. He has conducted federally funded basic research and industry research, giving him experience in solving problems that have theoretical significance and practical importance.

Prior to joining KU, Dr. Liu spent more than three years in the Standards Research Laboratory of Samsung Telecommunications America. He received the *Global Samsung Best Paper Award* in 2008 and 2010, respectively. In 2011, the National Engineers Week Foundation selected Dr. Liu as one of its *New Faces of Engineering* and SAMSUNG Telecommunications America honored him with an *Individual Gold Medal*.

He received his Ph.D. in Electrical & Computer Engineering from Texas A&M University in 2006.





FACULTY AWARDS

student in 2008, Calnon and other students wanted to participate in the Space Robotics Challenge. Dr. Agah created a special topics course for the students and helped them write grant proposals to fund the project and present it at the International Conference on Robotics and Automation.

"Professor Agah has a true desire to see his students succeed. Whether assisting students with their research or encouraging students to participate in educational outreach, Professor Agah is always willing to spend as much time and effort as necessary to provide his students with opportunities to grow, both academically and personally," says Calnon.

> EECS doctoral student **Chris Redford** has Dr. Agah as his adviser. In addition to taking several courses from Dr. Agah, Redford conducts artificial intelligence under his direction.

"He has been a fantastic adviser. He finds

interesting elements in your ideas and helps you develop a concrete plan for how to achieve them. I always leave his office with a clearer idea of what I need to do and the motivation to do it," says Redford.

Top Photo: EECS Professor Arvin Agah (left) examines research findings with EECS doctoral student Chris Redford.

Inset picture: Mark Heider, president of Commerce Bank, presents EECS Professor Arvin Agah with a \$7,500 check as part of his W.T. Kemper Fellowship for Teaching Excellence.

Agah Earns Teaching Award

ECS Professor **Arvin Agah** received a surprise visit from KU Provost **Jeffrey Vitter** and other dignitaries during his Mobile Robotics class on August 23. They presented him with a Kemper Fellowship for Teaching Excellence Award and a \$7,500 check.

Each fall the Kemper fellowships recognize 10 outstanding teachers and advisers at KU. Now in their 16th year, the awards are supported by an annual gift from the William T. Kemper Foundation and matching funds from KU Endowment. Dr. Agah is the eighth EECS professor to receive a Kemper award.

Andrea Valdivia had Dr. Agah for Software Engineering in 2008. Students worked in small teams to develop a Nintendo DS game, which she said was a great conversation starter during internship interviews. Valdivia said the career-oriented course showcased Dr. Agah's strong industry background and his passion for software development.

"Professor

Agah's Software Engineering class was one of my favorites at KU! It was an extremely hands-on course that gave students a flavor of what it is like to develop solutions for real-world scenarios," said Valdivia, who graduated in May and is working at the Goldman Sachs world headquarters in New York. "His enthusiastic teaching has made a lasting impression on me and certainly countless others."

Mark Calnon returned to KU this fall to begin his doctorate work under the direction of Dr. Agah. As an EECS graduate



FACULTY AWARDS » »

Innovative Teachers-Scholars Receive Tenure

ECS Associate Professors Jun "Luke" Huan, Carl Leuschen, and James P.G. Sterbenz received tenure this summer. Drs. Huan and Leuschen were promoted to Associate Professor.

In 2009, Dr. Huan received the CAREER Award, one of the most prestigious

honors from the National Science Foundation given to junior faculty members. The Faculty Early Career Development (CAREER) Award



recognizes professors who are integrating education and research in innovative ways. Dr. Huan has taught undergraduate courses in data structures and database systems and graduate courses in pattern discovery and bioinformatics. Dr. Huan is developing computational tools to analyze interactions between chemical structures and biological systems, accelerating drug discovery and improving toxicity monitoring.

"When I wrote my first paper, he spent the whole night working with me and taught me how to express my ideas more clearly," said Ph.D. student **Hongliang Fei**. "I am learning not only research skills but also his dedication towards research."

In 2010, Dr. Huan led the effort to secure \$4 million in federal funding to renovate ITTC's Bioinformatics Computing Facility. Dr. Leuschen serves as the Deputy Director of CReSIS. His numerous duties include overseeing the development of the Snow radar, which measures the thickness of snow on top of sea ice and glaciers and enables more accurate assessments of glacier thickness. He has led multiple expeditions to Greenland and Antarctica and works extensively with NASA's Operation IceBridge, the largest airborne polar ice survey.

In 2010, he received a PolarTREC Service Award and a Miller Award for Research from the School of Engineering.

EECS senior **Brady Maasen** has taken Circuits I and II (EECS 312 and 512) from Dr. Leuschen. He says Dr. Leuschen's

extensive knowledge and interesting presentations make for engaging classes. As an undergraduate research assistant at



CReSIS for the past two years, Maasen has worked with Dr. Leuschen.

"Although he is not my direct supervisor, Dr. Leuschen always stops to help me. He took time to help me write a proposal for an Undergraduate Research Award," said Maasen.

In addition to the Circuits courses, Dr. Leuschen teaches graduate-level classes on radar systems and mentors CReSIS students. Dr. Sterbenz teaches graduate networking and undergraduate digital design courses.

He has served as the chair or a member of more than 25 graduate and Ph.D. committees.



His communications and networking

research emphasizes resilient and survivable networking in future Internet design and engineering. Dr. Sterbenz' group is developing flexible and programmable network infrastructure to support a more mobile, secure Internet. He has received multiple prestigious NSF grants including a Future Internet Design (FIND) and Global Environment for Networking Innovations (GENI).

Dr. Sterbenz' research group earned Best Graduate Student Paper Award at the at the International Telemetering Conference (ITC) in October. They designed reliable networks able to transmit large amounts of data over limited bandwidth with intermittent connectivity for multiple test aircraft traveling at Mach speeds.

"Professor Sterbenz demonstrates an exceptional passion for advancing the state of the art in resilient and survivable networks, as is clearly evident in the output of his ResiliNets research program," said **Justin Rohrer** (Ph.D.EE '11). "This same passion comes across in the classroom, in his preparation for lectures, and interaction with students."



Allen Wins Talley Teaching Award

eniors honored EECS Professor Christopher Allen with the Harry Talley Award for Teaching Excellence in the May. This marks the second time Dr. Allen has won the award, which is voted upon by graduating EECS seniors for the professor who has contributed significantly to their education and has developed a strong rapport with them.

Dr. Allen teaches the Senior Design Laboratory (EECS 501 and 502). The yearlong capstone course is the culmination of the EE program and serves as bridge between the classroom and industry. Seniors apply what they have learned throughout their EECS coursework to solve real-world engineering problems. They design, build, and assess systems that adhere to industry standards and gain communication and presentation experience.

Levi Lyons (BSEE '11) had Dr. Allen for his Senior Design Laboratory. The tremendous amount of thought involved in the physical design of the circuit and the work needed to complete the project on schedule are crucial skills for engineers, says Lyons, who is now an Engineer-in-Training at Southwest Power Pool in Little Rock, Ark. Dr. Allen helped guide students through the process.

"Dr. Allen is very deserving of the Harry Talley Award," said Lyons. "He had high expectations and pushed us to attend weekly meetings with him to ensure our progress. During these meetings, we could be sure that he would ask us a question that would stump us and force us reevaluate some aspect that we had



Eta Kappa Nu President Joel Schmelzle presents EECS Professor Christopher Allen with the Harry Talley Award for Teaching Excellence at the Graduation Banquet.

not even considered! But he was always there to lend a helping hand and to make sure we were on the right track."

Dr. Allen advised the first hybrid team of Jayhawk Motorsports of which **Travis Bland** (BSEE '11) was a member. In addition to seeking Dr. Allen's help on the hybrid vehicle, Bland also had him for his Senior Design Laboratory. Bland said both projects helped prepare him for his job as On-Board Diagnostics Calibration Engineer at Chrysler in Chelsea, Mich.

"Most all of the great professors I had at KU and in EECS had one thing in common with Professor Allen—they genuinely cared about their students," said Bland. "I really believe that Dr. Allen wanted us to learn. His feedback was sincere and helpful; it never seemed like he was simply going through the motions."

Dr. Allen received the John E. Sharp and Winifred E. Sharp Teaching Professorship from the School of Engineering in 2002 and a W.T. Kemper Fellowship for Teaching Excellence and Ned N. Fleming Trust Award for Excellence in Teaching, both from KU in 2001.

Perrins Selected for Area Editor Position

ECS Associate Professor **Erik Perrins** has accepted an invitation to serve as an Area Editor for the *IEEE Transactions on Communications*. His duties include assigning papers to the

13 editors within the modulation and signal design area, monitoring their performance, and assisting the editor-in-chief.



"Erik is an internationally renowned

researcher in the field of modulation and signal design for telecommunication systems. He has served as an editor for several years and has done an excellent job in this capacity," said Robert Schober, a professor in the Department of Electrical and Computer Engineering at the University of British Columbia, who nominated Dr. Perrins for the position. "This made him a natural choice when the position of Area Editor became vacant."

Dr. Perrins' research expertise is in wireless communications. He recently received a Department of Defense research grant to help develop new communications architectures for flight test telemetry—measuring at a distance. By simultaneously allowing multiple tests to take place over hundreds of square miles, the integrated Network Enhanced Telemetry (iNET) program is a significant upgrade in aircraft testing.

Prior to Area Editor, Dr. Perrins served for four years as an editor for the journal.



UNDERGRADUATE SPOTLIGHT

Meet EECS senior Hilary Barbour

Hilary is the president of the Center for Remote Sensing of Ice Sheets (CReSIS) student organization and a member of the Jayhawk Motorsports team, the KU Indoor Intramural Soccer Team, and KU Swim Club.

What are your top tips for new students?

My advice for new students is to get involved in a club. I joined KU Swim Club my junior year, and I regret not doing it sooner. I met great people who love to swim. We traveled to competitions, which were always a blast. It's always worthwhile to branch out of engineering to diversify yourself.

Another opportunity I highly recommend is study abroad. I studied language in Germany, and it changed my life. I met some great people, tried wonderful German cuisine, and saw many regions of Germany and a couple surrounding countries.

What is a typical day like?

A typical day for me this year is to wake up and eat breakfast (very important!) before heading off to class. If I have a short break between classes, I hang out in the EECS Computer Commons or the Senior Design Lab to work on homework or projects. If I have a long break, I usually go to work for a few hours. If there is not a Jayhawk Motorsports meeting, a huge project due, or a KU Basketball game, I try to go to the gym. If I have a pile of homework to do, I skip the gym and work on it at home. While this year is quite busy, a typical day in my previous years as an EECS student was a bit more relaxed.

What have been some highlights and challenges?

One great thing about KU is that it is a large university. There is always something to do, and you have the opportunity to meet many different kinds of people. EECS students have a building that was built with them in mind. Eaton Hall has 24-hour access to its computing facilities and some of the design labs. This becomes a blessing in your senior year. Time

management is a challenge. I like to take the opportunities offered to me, but balancing school, work, clubs, and other extracurricular activities is tough at times.

What has been overall experience as an EECS student?

Electrical engineering isn't the easiest of programs, but it is one of the most rewarding. I get more from my EECS classes than any others because they are challenging, yet engaging.

What have been some of your favorite times at KU?

I love going to KU basketball games. The atmosphere is so energized. You can't help going crazy when a player lands an awesome dunk. I have also enjoyed Lawrence's social scene. Going to Mass Street is always a good time, whether you're eating out, shopping, or going out with friends.

What are your plans after graduation?

I hope to pursue a master's degree in electrical engineering. I am open to attending a university in the U.S. or Europe. With my bachelor's and, hopefully, master's degrees, I plan to work overseas or for a company where I can travel.



Major: Electrical Engineering Hometown: Winfield, KS Anticipated Graduation: May 2012 Future Plans: Graduate School

www.eecs.ku.edu



STUDENT SUCCESS

EECS Student Leads Art Project on Climate Change

olan Lem, an EECS sophomore, formed an interdisciplinary group to transform raw data on climate change into a multimedia art installation.

The KU group used sound and information graphics to illustrate glaciological data from the past 400,000 years. Mutatis Mutandis, a Latin phrase meaning "by changing those things that need to be changed," was on display during the spring semester at the Commons in Spooner Hall.

"Much of what Mutatis Mutandis explores is the audio-visual representation of time durations," said Lem. "By representing these extremely long time spans in shorter intervals, trends are made more urgent and accessible."

An accomplished saxophone player, Lem interned with Kip Haaheim, associate professor of music, in the fall of 2010. Their work with programming and audiovisual environments inspired Mutatis Mutandis. Dr. Haaheim said the idea of using hard data on ice sheets and sounds recorded from actual Arctic environments was compelling. He helped repurpose the recordings while Lem developed a



EECS student Nolan Lem (back), graphic designer Tristan Telander, and Associate Professor of Music Kip Haaheim used sound clips and visual images to demonstrate changes in the polar regions over thousands of years.

Photo by David McKinney/University Relations

computer program to interpret data and generate the sounds. Twelve speakers across the Commons played various pieces, including ice cracking that represented climate change over 40,000 years.

"I have worked on several such projects in the professional world and the result of people with widely varying interests and skills can produce profoundly creative results," said Dr. Haaheim. Tristan Telander, graphic designer at the Spencer Museum of Art, created four large-scale visualizations that range from 4 to 25 feet in length. She turned data into binary pixels to give images a processed and quantified look. With greater perspective, the pixels began to form more meaningful images.

The Center for Remote Sensing of Ice Sheets was among the organizations that provided data for the project.

The following EECS students received \$233,946 in scholarships for the 2011-2012 academic year.

Michael Albert, Bradley Bell, Shannon Bisges, James Butts, William Carey, Daniel Collins, Joshua Collins, Isaac Cook, Koosha Daneshi, Emily Dellwig, Dipankar Dey, Logan Downes, Kyle Engelken, Jason Eslick, Zachary Flies, Gordon Fry, Danielle Fuller, Zachary Garber, Tamara Gaynes, Patrick Gegen, Rachel Gilman, Howard Grimberg, Ben Guensche, Christopher Hale, Christopher Hudson, Christopher Hurd, Mason Johnson, Robert Kelly, Robert Knight, Alec Kohl, Alexander Larson, Peter Lesslie, George Li, Brady Maasen, Andrew Manderfeld, Jared Mar, Stacy Mar, David Mattione, Gregory Matthies, Paul McArdle, Elise McEllhiney, David Motsonashvili, Devin Mullins, Jonathan Owen, Amanda Parks, Paul Plotkin, Parker Roth, Keeler Russell, Jeffrey Sanoubane, Derek Scalzi, Garrett Scarlett, Tarryn Schantell, Joel Schmelzle, Chandler Schmidt, Ryan Scott, Cody Soden, Jonathan Stacy, Scott Stryker, Sean Sweeney, Andrew Taylor, Brice Thrower, Ian Weller, Levi Werner, Matthew Werner, Lee Wu, and Mikhail Zakharov



Self Fellows » »

Students Design High School Programming Contest

hen EECS juniors **Luke Ezell**, **Chris Hudson**, and **Matt Werner** were building and testing the courses for the first-ever Lego Mindstorm Competition in November, they wondered if high school students would be interested in the new programming event. The answer was a resounding yes, as people packed the EECS Conference room for more than four hours to watch robots try and navigate the three courses.

The Lego Mindstorm Competition was part of the School of Engineering's High School Design Competition, which tests high school students' creativity, teamwork skills, as well as their technical knowledge and ability. The Self Engineering Leadership Fellows Program, which Ezell, Hudson, and Werner are part of, plans the annual event. EECS Assistant Professor **Andy Gill**, who provided faculty support for the contest, suggested using Lego Mindstorm robots for their blend of real-world challenges and programming.

Nineteen teams registered for the Lego Mindstorm Competition. The School of Engineering bought each team a kit, which contained software and hardware to create small, programmable robots. The teams were sent a video, schematics, and pictures of the first course. The EECS group sent basic layouts of the following two courses, which were progressively harder. The high school students built the robots and programmed them with touch, color, ultrasonic, and other sensors. These were all designed to identify obstacles and maneuver around them. Tyler Haas, a math teacher at McLouth High School, brought seven students to the competition. McLouth is a small school and does not have the ability to offer programming



(I to r) EECS juniors Chris Hudson, Matt Werner, and Luke Ezell built three courses for the first programming contest during the High School Design Competition in November. Nineteen high school teams built robots that tried to maneuver the courses.

classes, said Haas. When he found out about the competition, he asked his Calculus class if they wanted to participate. Students stayed after school and spent weekends working on the robot. Their hard work paid off as McLouth finished second in the competition.

"We learned about the competition late, so the students only had about a month to work on it. They really rose to the occasion. When the programs finally worked, they had such a feeling of success. It was good to see," said Haas.

The first course included formidable toilet paper rolls that robots had to avoid and a sand ramp that foiled many attempts. Weight, wheel clearance, and sensor placement were a few factors that students had to consider when building their robot, said Ezell. Additionally, the color sensor needed to recognize the red

A Lego Mindstorm robot tries to maneuver a ramp on the second course. High school teams built and programmed robots to navigate courses built by EECS students.

line at the end of the course and stop. Teams had five minutes to complete the course. If they did not, they would be put at the end of the list and would then set about making changes for the next run.

"When any team passed a course, the whole room filled with excitement and applause, primarily from the other teams and coaches," said Werner.

The second course included a gate that robots had to open and pass through along with additional obstacles. Only one team managed to complete the last course, which included a large ramp and hairpin turns.





Self Fellows Explore Engineering, Culture in Brazil

By Cody Howard

ECS seniors **Emily Dellwig** and **Garrett Scarlett** were among the 15 Self Engineering Leadership Fellows who went to Brazil in August. The group visited the cities of Rio de Janeiro and Sao Paulo during their 10-day trip to learn about engineering challenges in the burgeoning world power, while attempting to manage the impact on the environment.

Each senior class in the SELF Program is charged with planning and implementing an experience that encompasses all engineering disciplines, as well as the pillars of the program, which include business, engineering, entrepreneurship, leadership, management, and communication. The students selected to organize an information-gathering trip to Brazil because of its rapid economic growth and unique position of hosting two major worldwide sporting events in the next five years – the 2014 World Cup and the 2016 Summer Olympics.

"We were really interested to learn more about how they're going to handle hosting two of the world's largest events," said Scarlett. "They have to undergo a lot of changes to modernize Rio, to get the infrastructure – things like streets and sanitation – ready to handle all those people."

The trip focused on engineering expansion, the environment, energy usage, and economics. The Fellows met with representatives from Petrobras, the third largest energy company in the world; the Brazilian aircraft manufacturing company Embraer; Ford Motor Company; and Embrapa, which focuses on the sustainable development of Brazilian agribusiness.

In October, Dellwig and Scarlett were among

the presenters at "Economic Growth and Engineering Expansion," the first lecture in a four-part series given by the Self students on Brazil.



Top Picture: EECS seniors Emily Dellwig (left) and Garrett Scarlett talked about their trip to Brazil at the "Economic Growth and Engineering Expansion" lecture.

The Self Fellows visited Maracana Stadium, the soccer stadium being constructed for the 2014 World Cup in Brazil.

Photo Courtesy of Self Program

Did You Know?

Each year 20 to 25 incoming freshmen with a track record of motivation, leadership, and action will be selected for the Self Engineering Leadership Fellows (SELF) Program. SELF Fellows receive an outstanding enrichment and leadership program paired with \$5,000 in fellowship funds in both their freshman and sophomore years and \$7,000 in each of their junior and senior years. Since its creation in 2007, nine EECS students have been selected for Self Fellowships.



JAYHAWK MOTORSPORTS » »

Students Build First Green Jayhawk Motorsports Cars

f **Emily Dellwig** would have had a free moment in the week leading up to KU's first hybrid vehicle competition in May, she may have wondered if she had taken on too much. Fortunately for Jayhawk Motorsports, the EECS junior did not have a millisecond unaccounted for. Dellwig and her team logged 60 hours each, including over a 24-hour period of no sleep, in preparation for the Formula Hybrid International Competition in New Hampshire. Their hard work paid off with a top 10 finish.

The final sprint marked the end of a 10-month marathon senior design project for EECS seniors Travis Bland, Hou Wenshuai, and Tyler Danaver, who with their team leader Dellwig, were members of inaugural Hybrid Power Train team for Jayhawk Motorsports. Traditionally, approximately 20 seniors in Mechanical Engineering spend the school year designing, manufacturing, and testing a Formula-style race car for their capstone project, with the help of KU student volunteers from various majors. Growing interest in hybrid vehicles led Jayhawk Motorsports to include the hybrid car along with its standard race car for the 2011 competition.

Each year, seasoned students teach the newbies in Jayhawk Motorsports. But as the first group, the hybrid team could not turn to older students for guidance. Dellwig says they learned along the way and turned to professors when they were at a loss, noting EECS Professors **Christopher Allen, Ken Demarest**, and **David Petr** were especially helpful. The EECS Department also provided \$10,000 toward the project.

"Because this was the first year for the project, there were a lot of new challenges and problems to solve. We turned to professors, the Department, and even people from industry for advice and guidance," said Dellwig.

The Formula Hybrid competition allows teams to retrofit old Formula-one cars instead of building an

entirely new chassis. Students built a new drive train and redesigned rear suspension components for the electric motor on the 2009 car. In addition to devising new electrical components, they had to factor in mechanical aspects, such as packaging components and making room for moving parts and weight. Each decision impacts the overall performance of the car, says Dellwig. If a bolt fails, the vehicle could fail, which makes it necessary to take an individual and systematic approach. She enjoys the challenge of integrating various technologies and taking a large, complex project from start to finish.

Of the more than 30 teams at the competition, KU was one of only 11 to pass the electrical and mechanical technical inspections. After passing inspection, cars participated in a drag race



Team leader Emily Dellwig makes adjustments to the Jayhawk Motorsports car during the Formula Hybrid International Competition in May. Photo by Kathryn LoConte Lapierre

to test acceleration, an autocross and an endurance event to push the car to its limits and to see how much energy could be consumed. Students also presented judges with an overview of their work, highlighting design innovations and marketing strategies to potential investors. The KU team finished in ninth place.

"Working on the hybrid was probably the best thing I did at KU. It was an entirely different kind of project. It really emulated real-world engineering," said Bland (BSEE '11). "Being a part of the first hybrid team, most of our answers were discovered through trial and error."

"I think after this year's team finishes its incredible plans that Formula Hybrid or Formula Electric will be a part of Jayhawk Motorsports for a long time. I hope it



leads to more interdisciplinary courses, but mostly, I hope it leads to KU being a powerhouse in Formula Hybrid and/ or Formula Electric competitions," added Bland, now an On-Board Diagnostics Calibration Engineer at Chrysler.

2012 Competition

Now in her senior year with a competition under her belt, Dellwig is team leader for the electric car being built by Jayhawk Motorsports. The team is competing in the first electric-only challenge at the Formula Hybrid International Competition in May. The Department once again provided a \$10,000 donation.

The number of EECS students has almost doubled. Seven are participating this year. Dellwig attributes this to greater student awareness of the event and course credit for participation in Jayhawk Motorsports. Students conduct research during the week and attend a weekly meeting on Tuesday nights to discuss their progress. They spend most every Saturday from 9 a.m. to 1 p.m. in the Jayhawk Motorsport Shop where they continue research and collaboration with team members. In January, students will begin manufacturing components and custom parts for the car. The majority of work is done on campus, which makes KU unique among college teams.

EECS seniors **Faiz Ahmed** and **Hilary Barbour** are working on regeneration breaking, which allows the motor controllers to recover the energy lost in braking. The energy is stored in the batteries, allowing the car to run for longer periods. They plan to achieve this by modifying the motor controller and optimizing regenerative braking to make it as efficient as possible.

"Everyone has been extremely dedicated to this project," said Ahmed. "The biggest challenge this spring will be implementing all the designs that we created in the fall. Getting everything to work together and the way we want to will be challenging."

While he has worked on motorcycles and cars since childhood, EECS senior Aric Beaver was not sure if he could devote the volunteer time needed for Jayhawk Motorsports. But when he learned he could earn course credit for it, he was in. Beaver's main focus is designing the electric differential that will supply torque to the wheels separately based on information from sensors on the car. Beaver has been researching how to increase overall stability while enhancing response time - often conflicting attributes.

EECS senior **Alex Drees** is working with the battery monitoring system and the low voltage start-up sequence. Safety is extremely important when dealing with high voltage, not only to the people involved but also the equipment. By monitoring the different parts of the car, such as batteries and motors, the team is increasing the safety and lifetime of the car.

EECS seniors **Garrett Scarlett** and **Brett Hermann** are finishing up their design



EECS seniors Faiz Ahmed (left) and Hilary Barbour work on regeneration breaking, allowing the motor controllers to recover the energy lost in braking. The team spends their Saturdays throughout the school year in the lab building the electric car.

of the high voltage system and all the components that entails. They have been working with interconnects between the motors, motor controllers, and batteries as well as making sure this system is protected from too much current.

The Formula Hybrid International Competition will run April 30 through May 3 at the New Hampshire Motor Speedway.



GRADUATE SPOTLIGHT

Meet EECS doctoral student Michael Jantz

Michael (BSCS '08 and MSCS '10) received a Special Recognition Scholarship from Upsilon Pi Epsilon, the leading computer honor society. Jantz, the president of the KU UPE chapter, was one of only four recipients of the award for the 2011-2012 academic year.

What are your top tips for new graduate students?

Choose your adviser carefully. The relationship you have with your adviser will be the most important professional relationship you have during graduate school. Make sure that your adviser is someone you trust and can work with.

Learn to manage your time well. It is easy to spend all of your time on coursework, but you need to learn to balance your time between coursework, teaching, and research. Having a personal life (away from graduate school) will help you maintain some level of sanity. It is crucial that you learn to recognize and appreciate thoughtful criticism.

As a student, it is easy to be intimidated by your peers and professors. I have found that if you work hard and have confidence in your own abilities that you will surprise yourself with how much you are able to achieve.

What is a typical day like?

Typical days vary from semester to semester, depending on my schedule. Last semester, I worked as a graduate research assistant and did not take any classes, so each day was pretty much solely devoted to research. Next semester, I will work as a graduate teaching assistant

and take one course. [In 2010, Jantz received the Paul F. Huebner Memorial Award for Excellence in Teaching. He has been the graduate teaching assistant for Introduction to Operating Systems (EECS 678) for five semesters.] I plan on dividing my week into days spent on teaching and coursework and days spent on research.

What have been some highlights and challenges?

I came to graduate school because I really like the idea of researching fundamental problems in computer science. Research is definitely the most challenging part of graduate school, but for me, also the most rewarding. Having my work accepted at top tier computer science conferences, including Languages, Compilers, and Tools for Embedded Systems and Compilers, Architectures, and Synthesis for Embedded Systems, has been the most rewarding experience.

Share with us your overall experience as an EECS student.

Being at KU for both my graduate and undergraduate education, and in EECS specifically, has been a wonderful experience. I have met some excellent professors who have pushed me and helped me develop my professional skills. I've also become really good friends with several of my classmates and labmates. I've been here over seven years now and will be very sad when the time comes to go.

Please explain your research.

My research focuses on computer systems design, specifically system-level and compiler optimizations. This sort of research has the potential to benefit everything from large-scale server applications to tiny embedded devices that need lots of processing power. Currently, I am investigating different compilation strategies for virtual machines running in multi- and many-core environments.





GRADUATE STUDENT SUCCESS

NSF Fellows Teach Math, Science in Middle Schools

ECS doctoral students **Mark Calnon** and **Andrew Farmer** have received National Science Foundation Graduate STEM in K-12 Education (GK-12) Fellowships. They will be leading hands-on activities in science, technology, engineering, and mathematics (STEM) in area middle schools to improve their communication and teaching skills while enriching STEM instruction in partner schools.

The one-year award provides each student with \$30,000 plus tuition and critical classroom experience for the aspiring teachers.

"Middle school is when many students seem to give up on science and math, saying 'I'm not a math person' or 'I'm never going to use this'. By showing students how math and science skills apply outside the classroom, in research and decision making, we hope to ignite their curiosity and develop the ability to ask good scientific questions and conduct research themselves," said Farmer, who works at Landon Middle school in Topeka.

In one popular lesson, Farmer divided Teresa Trauthwein's eighth grade math class into small groups and had them create instructions for building a small Lego structure. After 15 minutes, each group dismantled their creation and passed the pieces and instructions to another group, which then rebuilt it. Afterwards, they compared pictures of the original and rebuilt structures, which usually had little in common. Farmer wanted students to see how ambiguous instructions can be. Next they worked on



EECS doctoral student Andrew Farmer, middle, helps his eighth grade students work through a math problem at Landon Middle School. Farmer teaches at Landon one day a week as part of his National Science Foundation Graduate STEM in K-12 Education (GK-12) Fellowship.

creating a formal language for specifying how to build a Lego structure.

"Andrew brings innovative, thought provoking problems into the classroom that challenge the students," said Trauthwein. "Somehow, they stretch themselves and learn more than they ever thought they could. I am always amazed at the deep level of thinking he can achieve with them.

While volunteering with the Center for Remote Sensing of Ice Sheets (CReSIS) education team, Calnon had the opportunity to advise a local middle school's Science Olympiad team on a robotics project. Through this experience, he saw firsthand the effectiveness of using robotics and other innovations in STEM education.

He has brought that creativity to Harry Purrington's science classes at Arrowhead Middle School in Kansas City. Calnon led a lesson in tectonic plate movement this fall. Calnon learned GPlates modeling software and installed it on the 30 student laptops. He asked the eighth graders to find out how far apart South America and Africa were 60 million years ago. Using the software, students could reposition the globe and watch different continents shift over time, measure the distance between continents, and watch as new crust was created.

"Mark came in, pretty early in the year, and taught all of the eighth graders how to use Powerpoint. This was after he quickly learned how to negotiate our laptops," said Purrington. "Another outstanding lesson was when he downloaded a program to show continental movement over millions of years. He did not just do this on one computer, but a classroom set! He sat in the back with 10 or more laptops around him at a time, getting them prepared for his next visit. This allowed students to manipulate the program themselves and not just watch a teacher do it."



GRADUATE STUDENT SUCCESS » »

DoD Awards Austin Prestigious SMART Scholarship

ncreasing the security and maintainability of computer systems has earned EECS doctoral student **Evan Austin** a prestigious Department of Defense (DoD) scholarship.

The Shawnee native will receive a \$38,000 annual stipend, full tuition and fees, book allowance, and health insurance through the Science, Mathematics, And Research for Transformation (SMART) Scholarship for Service Program.

"Evan has worked very hard and we're all very proud of him," said School of Engineering Dean **Stuart Bell**. "The home-grown talent at the KU School of Engineering continues to excel at the highest levels of scholarship and research. This award is a great honor and the work he's completing at KU will play an important role in the security of the information technology we all rely on."

SMART recipients receive paid summer internships and postgraduate employment within the DoD. The program, which aims to bring highly trained civilian scientists and engineers to Defense facilities, requires a year of employment in return for each year of scholarship.

"Beyond the generous financial benefits attached to the award, the SMART program provides years of invaluable experience at a DoD research facility," said Austin. "When I look at the incredible new professors EECS has gained over the last few years, I notice many are finding immediate success based on the contacts



Ph.D. student Evan Austin is building formal reasoning tools that allow researchers to build models that evaluate their hardware and software designs. This spring he received a Department of Defense SMART Scholarship.

and confidence that they developed working at government research labs. I'm hoping that this opportunity will provide me with a similar foundation that I can build upon for success."

Current verification software does not provide sufficient automatic processing, creating a slow and cumbersome inspection process. Austin is developing formal reasoning tools that will allow researchers to build models that evaluate the security, reliability, maintainability, and other important facets of their hardware/software design. His tools are aimed at expediting the generation of trustworthy large-scale systems, such as smart grids. Austin conducts research at ITTC under the direction of EECS Professor **Perry Alexander**.

"Evan is an exceptionally talented researcher and a wonderful member of my laboratory," said Dr. Alexander. "The SMART fellowship suits him quite well, and I believe the experience he will gain working with the DoD will benefit him greatly when he starts his career in academia. This fellowship is great for Evan and great for ITTC and KU."

Austin is the third EECS student to receive a SMART fellowship since it began in 2005. Alumni **Jamie Jenshak** and **Mike Wasikowski** were former recipients.



Shi Chosen for KU Self Fellowship

ECS doctoral student **Lei Shi** has been selected for a Madison and Lila Self Graduate Fellowship. He is one of eight students chosen for the 2011 Fellowship.

The Self Graduate Fellowship provides financial assistance and development opportunities for new or first-year KU doctoral



students. The four-year award, which exceeds \$164,000 in total value, covers tuition and fees and provides an annual stipend. Along with financial assistance, Fellows receive extensive leadership training through the Fellow Development Program.

"I was extremely excited to hear that I had been selected" said Shi, who is from Wichita. "I want to thank all of the people who supported me in this process and I'm looking forward to taking full advantage of all of the opportunities the Self Graduate Fellowship offers."

"I am delighted that the Self Fellowship selection team recognized value in Lei's career goals, achievements, vision, and leadership skills in their decision to select Lei to be a Self Fellow," said Shi's advisor, EECS Professor **Christopher Allen**. "This four-year award and the Fellow Development Program will enable Lei to fully develop his Ph.D. studies and research goals."

Shi has been a graduate teaching assistant (GTA) for the Electronic Circuits II (EECS 412) lab, which focuses on practical testing and characterization of electronic amplifiers. He enjoys teaching and sharing his knowledge and experience from his days as an electrical engineer at Honeywell FM&T with his class. Students recognized his commitment and affability with a standing ovation at the end of last semester.

"Lei Shi was the most outgoing, dedicated GTA I have had at KU," said **Tom Willger**, who had Shi for EECS 412. "Prior to the lab session each week, Lei would work through the entire laboratory to practice multiple debugging techniques. His thought process and approach to circuit analysis are skills that he tried to teach all of his students."

Shi is president of Graduate Engineering Association (GEA) after serving as its vice president during the 2010-2011 academic year. GEA represents the interests of graduate students within the School, administers the studentgenerated differential fees, and works with departmental student organizations.

Shi is the seventh EECS student to receive the Self Fellowship since its creation in 1989. The Self Fellowship Fund was created by a series of gifts to the KU Endowment Association from alumnus Madison and his wife, Lila.

Conferences Honor Student Research



EECS graduate students **Kamakshi Sirisha Pathapati** and **Nguyễn Ngọc Trúc Anh**, EECS Ph.D. student **Justin Rohrer**, and EECS Associate Professor **James P.G. Sterbenz** earned the Best Graduate Student Paper Award at the International Telemetering Conference (ITC) in October.

The group designed resilient, reliable networks able to transmit large amounts of data over limited bandwidth with intermittent connectivity for multiple test aircraft traveling at Mach speeds. "Performance Analysis of the AeroTP Transport Protocol for Highly-Dynamic Airborne Telemetry Networks" highlights the Airborne Network Telemetry Protocol (ANTP) suite.

EECS doctoral student **Hongliang Fei** won the Best Student Paper Award at the IEEE International Conference on Data Mining (ICDM) in December. The paper, "Structured Feature Selection and Task Relationship Inference for Multi-Task Learning," describes algorithms that enable more accurate, efficient predictive models of gene expressions and functional magnetic resonance imaging.

The algorithms, developed by Fei and EECS Associate Professor **Jun "Luke" Huan**, have a wide range of applications and serve as an important breakthrough in multi-task learning of massive and complex data sets.



GRADUATION BANQUET

The following students were honored at the Spring Graduation Reception on May 21.

Outstanding Senior Award

Based on overall achievement, the award is presented to a graduating senior in EE, CoE, and CS. Joel Schmelzle (EE), Brian Miller (CoE), and Nate Snyder (CS)

Ellermeier Memorial Award

A nontraditional student with outstanding scholastic achievement is the recipient of the Ellermeier award. It is given in honor of former EE Professor and Associate Dean of the Graduate School Robert Ellermeier.

Angela Wright

Everitt Award

The International Engineering Consortium sponsors the Everitt Awards, which are reserved for EECS seniors in the top 10 percent of their class. Winners must be interested in communications and computers and involved in outside activities.

Manas Bhatnagar and Wenshuai Hou

Paul F. Huebner Memorial Awards

Paul Huebner was a KU graduate with a BS in accounting, concentrating in CS, and a graduate degree in CS. The award is intended to reward good teaching and encourage students to consider teaching as a career. John Gibbons and Martin Kuehnhausen

Richard K. & Wilma S. Moore Thesis Award

This award is given in honor of Distinguished Professor Emeritus Richard Moore. The best graduate thesis and doctoral dissertation are honored. **Kevin Matlage (thesis) and Justin Ehrlich (dissertation)**



(I to r) Nate Snyder, Brian Miller, and Joel Schmelzle received the Outstanding Senior Award.



Angela Oguna, EECS Professor Gary Minden, and EECS doctoral student Martin Kuehnhausen worked together at KU's Information and Telecommunication Technology Center. Oguna graduated with Departmental honors, and Kuehnhausen won a Huebner Memorial Award.

Rummer Awards

Professor Emeritus Dale Rummer's dedication to engineering design was the impetus for the award. The awards are given for outstanding work done by seniors in CoE and EE capstone design courses.

Monte Jones, Andrew Holcomb, Brian Miller, and Michael Soderberg (CoE) Jay Fuller, Audrey Seybert, Bryan Townley, and Benjamin Trombold (EE)

Department Honors Manas Bhatnagar, Jonathan Lutes, Angela Oguna, and Masayuki Pak



Jay Fuller, Audrey Seybert, Benjamin Trombold, and Bryan Townley stand with EECS Professor Christopher Allen. Dr. Allen presented the winning group from his Senior Design class with the Rummer Award.



GRADUATES

Spring 2011

Jennifer Lohoefener, "A Methodology for Automated Verification of Rosetta Specification Transformations," Ph.D. CS, Adviser: Dr. W. Perry Alexander

Alexander Senf, "A Machine Learning Approach to Query Time-Series Microarray Data Sets for Functionally Related Genes Using Hidden Morkov Models," Ph.D. CS, Adviser: Dr. Xue-wen Chen

Zeeshan Ahmed, MSCS Hussain Al Hai, BSEE Andisheh Ataollahi, BSEE Hassan Bakhadlg, BSEE Anusha Bethi, MSCS * Manas Bhatnagar, BSEE Henry Brown, MSEE Tristan Bull, MSCoE Kendall Byington, BSCS Joseph Ciskey, BSCS Katherine Courtney, BSCS Jason Cradit, MSIT Tyler Danaver, BSEE Patrick Dermyer, BSCS Michael Dreiling, BSCS Abderrahmane Elandaloussi, BSEE Jonathan Ermey, BSCS Brian Fitzpatrick, BSEE Jose Florencio Neto, BSEE Jay Fuller, BSEE Yuan Gao, BSCoE Donald Gav, BSCS Timothy Gravlin, MSIT Eyob Hailemariam, BSEE Brigid Halling, BSCS Jacob Hamilton, BSEE Brandon Haverkamp, BSEE Tyler Hughes, BSEE Marianne Jantz, BSCS Monte Jones, BSCoE

Matthew Kitchen, BSEE Joshua Koenig, BSEE XingTao Liu, BSCS * Jonathan Lutes, BSCS Levi Lyons, BSEE Daniel Mantvla, BSCS John Mathew, MSCS Kevin Matlage, MSCS Robert McCue, BSCS Brian Miller, BSCoE Richard Moorhead, BSCS Davis Morgan, BSEE * Angela Oguna, BSEE Alex Oyler, BSCS * Masayuki Pak, BSEE Edward Patterson, BSCS • Raina Rahman, MSEE Gino Rea Zanabria, MSEE Bhavana Reshaboina, MSCoE Audrey Seybert, BSEE **Dipen Shah**, MSCS Trenton Shuey, BSEE Brandon Smith, BSCS Dylan Smith, BSCS Nathaniel Snyder, BSCS Michael Soderberg, BSCoE Thao Thieu, BSCS Sudha Tirichengodu Yegyanarayanan, MSCoE Benjamin Trombold, BSEE Devin F. Turner, BSCS Andrea Valdivia, BSCS Daniel Walter, BSEE Thomas Willger, BSEE Jeremy Wurmilinger, MSEE

Summer

 Serhiy Morozov, "A Distributed, Architecture-Centric Approach to Computing Accurate Recommendations from Very Large and Sparse Datasets," Ph.D. CS, Adviser: Dr. Hossein Saiedian



(I to r) Tyler Hughes, Audrey Seybert, Travis Bland, and Dan Walter attend the School of Engineering ceremony.



Masayuki Pak, Levi Lyons, Manas Bhatnagar, Jacob Hamilton, and Benjamin Trombold joke around before the SoE spring graduation ceremony in Allen Fieldhouse.

Mark Snyder, "Type Directed Specification Refinement," Ph.D. CS, Adviser: Dr. W. Perry Alexander

Evan Austin, MSCS
 Travis Bland, BSEE
 Daniel Broyles, MSIT
 Kyle Byers, MSEE
 Yuxin Chen, MSCS
 Wenshuai Hou, BSEE
 Rajprasad Loganathan, MSEE
 Mitchell Morrow, BSEE

- Hemanth Narra, MSCoE
- Tyrian Phagan, MSCS

Fall

Bing Han, "Detecting Cancer-Related Genes and Gene-Gene Interactions by Machine Learning Methods," Ph.D. CS, Adviser: Dr. Xue-wen Chen

 Thomas Higgins, "Waveform Diversity and Range-Coupled Adaptive Radar Signal Processing," Ph.D. EE, Adviser: Dr. Shannon Blunt

Suyang Ju, "Intelligent Approaches for Routing Protocols in Cognitive Ad-Hoc Networks," Ph.D. EE, Adviser: Dr. Joseph Evans

Wesley Peck, "Hardware/ Software Co-Design via Specifications," Ph.D. CS, Adviser: Dr. W. Perry Alexander ◆ Justin Rohrer, "End-to-End Resilience Mechanisms for Network Transport Protocols,"
 Ph.D. EE, Adviser: Dr. James P.G. Sterbenz

Aaron Smalter, "Clustered Boosting for Genome-Wide Protein-Chemical Interaction Predication," Ph.D. CS, Adviser: Dr. Jun "Luke" Huan

Patrick Dermyer, BSCS Derek Dobler, BSCS Daniel Gomez-Garcia, MSEE Trevor Handley, BSCS Victor Haskins, BSCS Jason Held, BSCS Andrew Holcomb, BSCoE Jong Cheol Jeong, MSCS Cameron Johnson, BSCoE Lakshmi Kosuru, MSEE Charles Mehrer, BSCS

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Jantzen Ward, BSCS

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RESEARCH » »

KU Selected to Host Trio of Prestigious Conferences

hanks to innovative EECS research, flyover country is becoming a destination spot for leading researchers in computing and engineering. Three international conferences were held on or near the University of Kansas in 2011.

EECS Associate Professors **Shannon Blunt** and **James Stiles** served as the General Chair and General co-Chair of the IEEE Radar Conference held in Kansas City. Professor Emeritus **Richard Moore**, the founder of the KU Radar Systems Lab and a pioneer of radar remote sensing, was the Honorary Chair. More than 20 EECS faculty, students, and alumni attended the conference.

"This is the most prestigious conference in the world dedicated solely to radar, and it's a great honor for KU to serve in this capacity," said Dr. Blunt. "People sometimes mistakenly think of radar as 'old technology'... but so is the telephone. The digital revolution has led to things like smartphones, and we're now starting to see similar advances for sensor technologies such as radar."

More than 400 scholars and industry practitioners from 28 countries exchanged ideas through technical presentations, poster sessions, tutorials, and industry exhibits. KU was selected to lead the conference in recognition of its accomplished history and continued excellence in radar research and development. In October, EECS Assistant Professor Andy Gill led the 23rd International Symposium on Implementation and Application of Functional Languages (IFL) held at the Kansas Union. More than 50 leading researchers and practitioners attended the event. This is only the second time the symposium has been held in the United States, and

nearly half of the participants were from abroad. IFL gave KU and Kansas great exposure, says Dr. Gill.

Functional programmers implement ideas from software engineering and mathematics to make high-assurance software development more manageable. Functional programming allows entire classes of programming errors to be eliminated, says Dr. Gill.

"Functional Programming is an important emerging technology, and neatly addresses outstanding issues with performance, parallelism, and correctness that exist with current software engineering practices. IFL is one of a number of venues for presenting breakthroughs with this specific applied engineering, and we were delighted to host IFL," said Dr. Gill.



(I to r) EECS Associate Professor and General Chair Shannon Blunt, Jason Fritz of Colorado Engineering Inc., and KU alumnus William Blake (BSCoE '05 and Ph.D.EE '10), now an aviation system and software engineer at Garmin International, chat before the IEEE Radar Conference Banquet.

EECS Professor **Perry Alexander** served as General Chair of the 26th Annual IEEE/ACM International Conference on Automated Software Engineering. In November, nearly 200 of the world's leading experts on software engineering gathered at KU to exchange research on the development of more efficient, reliable, and secure software systems.

Dr. Alexander said the conference provided a unique opportunity for regional industry representatives to interact with top researchers in software engineering. Conference attendees examined techniques for automating software synthesis, testing, analysis, and development processes.

"It was a thrill to have so many of my research colleagues in Lawrence for the conference," said Dr. Alexander.



Tools Test Software Correctness

echnology being developed at the University of Kansas will make it easier and cheaper to build highly dependable and secure software, potentially saving billions of dollars annually.

EECS Assistant Professor **Andy Gill** recently received a \$500,000 National Science Foundation grant to streamline tools for the development of high assurance computer systems. The innovative support tools will provide greater transparency and scrutiny when building critical components for large complex systems, dramatically reducing the all-too-common bugs and glitches that occur in current software.

When programmers build software, they first must determine how it will be used and then how it will function. They should then evaluate the software to ensure the description and function match, but this step is cumbersome and expensive. All too often, crude testing methods are used instead, inadvertently neglecting to test critical corner cases that later result in bugs in real-world deployment. A National Institute of Standards and Technology study found that software defects cost the economy \$60 billion annually and account for 80 percent of software development costs.

Dr. Gill is building the Haskell Equational Reasoning Model-to-Implementation Tunnel, nicknamed HERMIT, to improve software correctness. HERMIT mathematically, or formally, analyzes each step of development, providing rigorous connections between system requirements and the programming



EECS Assistant Professor Andy Gill (left) stands with invited speaker Bryan O'Sullivan at the International Symposium on Implementation and Application of Functional Languages (IFL) in October. Gill's research helped bring IFL to KU for the first time, and to the United States for only the second time.

details of a real application. While system requirements and programs are typically written in two different computer languages and often evaluated in a third, HERMIT provides a common foundation that generates evidence that the description and action match. These continuous checks and balances make it much harder for errors to be introduced, and HERMIT's precise documentation style allows any bugs to be caught early in the process.

"When we are talking about building large systems with millions of lines of code, finding errors can be very difficult. Unreliable software hurts companies' reputations and costs them customers," said Dr. Gill, who conducts his research at ITTC. "HERMIT uses new ideas from software engineering and mathematics to make the evaluation of highassurance software development more manageable."

Noise Hides Signals

ECS researchers have developed a new form of high-speed covert communication that leverages existing radar emissions.

EECS Associate Professor Shannon Blunt collaborated with EECS Associate Professor Erik Perrins and graduate students Justin Metcalf and Casey Biggs on the development of an intrapulse radar-embedded communication approach. The specially designed covert signals achieve the right trade-off between communication performance and interception avoidance. For example, the system may allow soldiers behind enemy lines to send secure messages by hiding signals among the echoes generated by a nearby high-powered radar. Intended receivers would have sufficient prior knowledge to recover the hidden signal, while eavesdroppers would be unaware of the signal's existence.

Such technology traditionally employs hundreds to thousands of radar pulses to insert covert signals. However, by inserting information into the echoes from each individual radar pulse, the EECS approach has the potential to increase the data rate by orders of magnitude.

The work, funded by a U.S. Air Force Young Investigator Award that Dr. Blunt received in 2007, culminated in the December publication of "Performance Characteristics and Metrics for Intra-Pulse Radar-Embedded Communication" in the prestigious *IEEE Journal of Selected Areas in Communications* (JSAC). The paper can be found at http://ieeexplore.ieee.org/stamp/ stamp.jsp?tp=&arnumber=6081358.



CRESIS RESEARCH » »

Data Collected on World's Fastest Flowing Glaciers

esearchers from the Center for the Remote Sensing of Ice Sheets (CReSIS) spent two months this spring in Greenland, measuring the ice thickness and surface topography of some of the fastest flowing glaciers in the world. The collected data allow climate researchers to better assess the changes in the Greenland ice sheet and make more accurate predictions of rising sea levels.

EECS Research Professor Fernando Rodriguez-Morales led the team that included EECS graduate students Daniel Gomez-Garcia and Logan Smith. The team completed 12 science flights over four different glaciers. Dr. Rodriguez-Morales oversaw the field operations and ran the Multi-Channel Radar Depth Sounder (MCoRDS), which measured ice thickness, during most flights. Gomez-Garcia operated the Accumulation radar and the Ku-band altimeter. The former maps variations in the snow accumulation rate while the latter retrieves ice surface topography data with high resolution. Gomez-Garcia also developed processing software for the radars. Smith, who remained on the ground most days, processed the data collected by the CReSIS radars.

"These are some of the most significant outlet glaciers, which are the main tributaries for getting ice from the interior of Greenland to the calving front, or out to the edges, where it breaks off into icebergs that melt and can potentially lead to a rise in sea level," said Smith. Researchers made a couple major changes to MCoRDS before the deployment. To improve resolution and increase the number of antenna elements, the MCoRDS operated at 195 MHz, as opposed to the traditional frequency of 150 MHz. CReSIS researchers decreased the size of antenna while increasing the number of them on each wing. This new configuration offered greater flexibility to rotate antenna orientation, helping reduce surface clutter in crevassed areas and minimize electronic

interference from aircraft sub-systems. The associated electronics were upgraded to capture the received signals from all 12 antenna elements, which enabled powerful beam forming capabilities in post-processing.

While Gomez-Garcia had taken part in the NASA Operation IceBridge program last year, this was his first trip to the Arctic. He said the smaller plane allowed him to more easily interact with Dr. Rodriguez-Morales and the pilots. The CReSIS group was the only one on board the Twin Otter aircraft, giving researchers greater flexibility with their flights. If the weather was good and they needed to take



EECS graduate student Daniel Gomez-Garcia takes calibration measurements during a flight.

Photo by Logan Smith

another pass over a target of interest, they could.

The sporadic spring weather complicated the mission. It became a wait-and-see game. The researchers would get up and prepare for a flight that could then be delayed or postponed for the day. Dr. Rodriguez-Morales noted that people who had been going there for 20 years said it was the worst year they had seen.

"What we're trying to achieve is always to get better results than previous years, and there's a lot of things that we have improved," said Gomez-Garcia.

Nick Mott contributed to this article.



The Center for the Remote Sensing of Ice Sheets (CReSIS) is working to better understand the dynamics of the world's ice sheets, their effect on sea level rise, and the subsequent impact on society.

CReSIS Assists in Largest Airborne Polar Ice Survey

ReSIS once again participated in NASA's Operation IceBridge mission this fall. IceBridge, the largest airborne survey of ice at the polar regions, marked its third year in the six-year reconnaissance project. An international team of researchers measured Antarctica's polar ice sheets and sea ice to help forecast how the ice sheets will respond to changes in climate.

"We imaged an ice rift in formation on Pine Island Glacier and flew surveys over Recovery and Slessor Glaciers, which have only been sparsely surveyed in the past. We also produced the first 3-D image of the ice bottom from the DC-8 platform, using the MCoRDS [Multi-Channel Radar Depth Sounder] array antennas this season," said CReSIS Assistant Research Professor **John Paden**, who was field leader and operated the MCoRDS radar.

"At a time when glaciers and ice sheets are showing rapid changes, we need consistent data that shows how and why that change is happening," said IceBridge Project Scientist Michael Studinger in a press release. "With three years of IceBridge data in hand, we have successfully continued the ice sheet elevation record in key areas and broken new ground in understanding the nature of the bedrock under ice sheets and the shape of the seafloor under ice shelves."

Three CReSIS radar systems were installed on NASA's DC-8 aircraft and flown over high risk areas. The MCoRDS, with an antenna mounted underneath the fuselage, measured the thickness of the ice sheet. It can be used to detect if liquid exists at the base of the ice sheet. The presence of liquid could greatly accelerate the movement of the ice sheets.

The Snow and Ku-band radars have antennas installed in the wing roots. The former can detect thin, annual

accumulation layers down to 60 meters depth. The Ku-band radar provides fine resolution surface topography to measure changes in the height of the ice sheets over time. The Ku-band radar is used to validate and better understand Cryosat-2 satellite radar measurements.

EECS doctoral student **Ben Panzer**, who ran the Snow and Ku-band radars, says the team doubled their sea ice flights—six this time. Sea ice thickness provides an indication of the stability of the Antarctic sea ice pack from year to year. The radars measure the snow thickness on the sea ice.

Depending on weather conditions, the missions were flown at low altitudes (1,000 to 2,000 feet above the surface). The Snow and Ku-band radars collect about 400 gigabytes of raw data for each



EECS doctoral student Ben Panzer (right) discusses research with NASA's John Sonntag as they fly over Pine Island Glacier in West Antarctica.

Photo courtesy of NASA

flight and the MCoRDS systems collects about 2 terabytes (TB) per flight, which resulted in over 40 TB of raw data for the whole season. In comparison, it took the Hubble Space Telescope 20 years to amass 45 TB of data.

EECS graduate student **Shashanka** Jagarlapudi, who took part in his first CReSIS deployment, processed data gathered from the 10-12 hour daily flights, when weather permitted. The CReSIS team logged more than 210 hours in the air.

Jennifer Salva and Shawn Schaller contributed to this article.



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Alumni Spotlight

Tshering Shares Incredible Journey to KU, Beyond

tarting his three-and-a-half hour walk down the mountain before dawn, **Nima Tshering** was terrified of running into a Himalayan black bear in the dark jungle. But the eight year old did not let fear stop him from making the seven-hour round trip six days a week for five years to primary school.

Tshering (BSEE '02) talked about his journey to KU and beyond during the EECS New Student Seminar this fall. EECS Professor and Associate Chair for Undergraduate Studies **David Petr** leads the one-hour weekly discussion to link students with resources and more quickly integrate them into the Department. Tshering was among the invited alumni asked to share their experiences and show the wide range of career paths for EECS graduates.

"Nima was an obvious choice as guest speaker for our week on unusual careers; his close association with the royal family of Bhutan, his strategic government positions, and his graduate study focused on management and public administration certainly make him one of EECS's most unusual graduates," said Dr. Petr.

"My EECS experience has turned my fear into hope, my self-doubt into confidence. It gave me the hard KU engineering skills with soft humility of Kansas" said Tshering, who came to KU on a Fulbright Scholarship. "When it comes to a career, I would like current EECS students to realize that it is not what you do, but how you think about what you do, that changes the world."



Nima Tshering (center) stands with two of his former EECS Professors David Petr (left) and Gary Minden. Tshering (BSEE '02) spoke to EECS freshmen about unusual career paths during the New Student Seminar.

After graduating from KU in 2002, Tshering joined Bhutan's Department of Information Technology and began building the nation's fledging IT infrastructure. Internet and cell phone service would be incredible advancements for a country that is still trying to extend roads and electricity to its rural villages, Tshering said. While KU had given him the engineering skills to succeed, he needed management training for the massive undertaking and enrolled in a graduate engineering management program at the University of Canterbury in New Zealand. For his graduate project, Tshering developed the strategic plan for Tarayana Foundation, a non-profit organization that helps poor Bhutanese in rural villages. He completed his graduate

degree in 2005 and spent the next three years walking to more than 300 remote villages in Bhutan to talk to his fellow citizens about the King's policies.

His work with the Tarayana Foundation and the King's Office of People's Welfare and Wellbeing led him to the John F. Kennedy School of Government at Harvard University. He is learning how to develop business approaches and public policies that will help the one-quarter of Bhutanese living in poverty, less than \$1 a day. Tshering, who is expected to graduate this summer with a Master's in Public Administration in International Development, will return to public service and nation building under the direction of the King of Bhutan.

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