Bryan Carroll (front), an ECE Department alum and member of the Utah Center for Assistive Technology, is pictured with three ECE seniors (back, from left: Haunani Hew-Len, Skyler Lund, and Jesus Loya) who made research strides in a software-based, hands-free automation network controller for U-HAND, the Utah Home Automation Network Device.

Home automation products provide more independence to disabled individuals who cannot use their hands. While the home automation industry offers extensive products, most controllers to manage these products require touch input. Additionally, managing IR devices, RF devices, and PC applications requires three separate controllers.

ECE students developed both the software and hardware necessary to integrate infrared, radio, and PC application control from a central console to remote household appliances.

The students demonstrated their research and working prototype at the ECE Technical Open House in April, 2010.
Message from the Chair

I consider it a great privilege to introduce myself as the new Chair of the ECE Department at the University of Utah.

Our department is growing and our faculty and staff have a clear goal in mind: be the finest public electrical and computer engineering department in the nation with our progressive educational curricula and our outstanding research programs.

We are already well on our way to reaching this goal: in 2009, our research expenditures surpassed $6.1 Million. This is nearly double the $3.1 Million we spent in 2005. In the same time period, our faculty grew from 17 members to 27 members, adding new and strengthening existing areas of interdisciplinary research in the Department.

We even increased our average course ratings as ranked by students from 4.76 to 5.20 out of a possible 6. Our metrics are improving both inside and outside the classroom.

We certainly have not achieved these milestones alone. Our alumni and donors are an integral part of our success. Your donations to scholarships make an engineering education affordable to Utah's best and brightest students. Your corporate sponsorships and partnerships give us the resources necessary to push the envelope in our interdisciplinary labs. And your participation in the high-tech market is making electrical engineering an integral career in the world economy.

If any stories in this newsletter strike a chord of personal interest, please consider supporting the efforts of our talented students and faculty by donating to the department. You can support scholarships, specific research, or our department goal with your gift. Our website has a front-page link to online donating where you can direct your gift to the specific area in the Department that you would most like to support.

We can't succeed without you.

I hope you enjoy this annual update on activities within the ECE Department, and thank you for your support.

Gianluca Lazzi
USTAR Professor and Chair
Electrical and Computer Engineering

Thomas and Mary Lu Judd Distinguished Lecture Series

The sixth annual Thomas and Mary Lu Judd Distinguished Lecture Series is coming to the ECE Department in 2010. The series brings outstanding leaders in engineering fields to campus to share their groundbreaking ideas with our students, alumni, and faculty members. The lecture series is open to the public.

The 2009 Lecture Series Speakers

Sunil Bhave of Cornell University presented “Micro and Nano Mechanical Signal Processors,” an overview of his research in resonators for radio, microwave and photonic front-ends, inertial sensors, acousto-optic and acoustomagnetic interactions. Dr. Bhave received the NSF Early CAREER Award in 2007 and the DARPA Young Faculty Award in 2008.

James S. Murday, Director for Physical Sciences in the DC Office of Research Advancement with the University of Southern California, discussed how the development of nanometer scale measurement/manipulation nearly 20 years ago led to nano-enabled technologies that are now penetrating the commercial marketplace.

Robert J. Trew, Director of the Electrical, Communications, and Cyber-Systems Division of the National Science Foundation, presented both current research programs and emerging opportunities in modern fields of electrical and computer engineering research.

2010 Distinguished Speakers

Upcoming seminars will be held during the Fall 2010 semester on Fridays at 3:05 p.m. Guests are also invited to have refreshments beginning at 2:45 p.m. Please watch the ECE calendar at www.ece.utah.edu for updates to the seminar schedule.
Faisal Khan
Assistant Professor

Faisal received his Ph.D. in Electrical Engineering from the University of Tennessee in 2007 while conducting research in high-power DC-DC converter designs for future fuel-cell vehicles. He then worked with the Electrical Power Research Institute (EPRI) as a Senior Power Electronics Engineer for 2 years before joining the Department in 2009.

Rajesh Menon
USTAR Assistant Professor

Rajesh Menon earned his Ph.D. from MIT and began working as a post-doctoral scientist and later as a research engineer at the Research Laboratory of Electronics at MIT. From 2005-2009, Rajesh was also the Chief Technology Officer of LumArray, Inc, a company he co-founded with colleagues at MIT. Rajesh has pioneered several technologies that will enable far-field optics to manipulate and image matter with nanoscale resolution.

Gianluca Lazzi
USTAR Professor and Department Chair

Gianluca Lazzi returned to Chair the ECE Department after originally earning his Ph.D. here in 1998. Gianluca's internationally recognized research in retinal prosthesis and wireless antenna systems contributes to outstanding programs in biomedical electromagnetics in ECE. Gianluca serves as Editor-in-Chief of the IEEE Antennas and Wireless Propagation Letters and has been honored with multiple teaching awards as well as the NSF CAREER award in 2001.

Darrin Young
USTAR Associate Professor

Darrin Young earned his Ph.D. from UC Berkeley in 1999 and taught at Case Western Reserve University for 10 years prior to joining the ECE Department. Darrin's research, funded through diverse sources such as NASA, DARPA, NSF, NIH, and others, focuses on Micro-Electro-Mechanical Systems design, fabrication, and integrated circuits design for wireless sensing, biomedical implants, communications, and general industrial applications.
“Smart Grid” technologies are improving the efficiency of the modern U.S. power grid network. Devices such as smart meters will increase efficiency and decrease consumption for the average home by communicating cost, load, and local production with the utility provider.

Five ECE seniors designed a smart meter that not only takes power from the distribution grid but also from any home distributed generation system. The meter uses a real-time pricing signal to prioritize and schedule loads in the emulated home as a response to pricing signals.

For example, when energy demand on the distribution grid reaches its maximal points during a normal 24-hour day (usually about 2:00 p.m. due to air conditioning loads), a dynamic pricing model would raise the price per kilowatt hour. A smart home meter in response could shut off power to those appliances running on a lower priority, such as a washing machine or dishwasher. Later when the prices respond to a drop in the power load by dropping themselves, the meter could once again signal the appliances to turn back on.

Such a system would save money for homeowners, more equally distribute power demand throughout the day by minimizing peaks, and provide a two-way communication channel between a home’s smart meter and the utility company providing the power.

This senior project, made possible by the Engineering Clinic Program sponsor Rocky Mountain Power, will be continued in 2010-2011 with a new team of talented students.
Massood Tabib-Azar reveals how to grow self-welded metal-catalyzed carbon nanotube bridges that can be used to form solid electrolytic non-volatile memories in U.S Patent 7,640,226.

Massood developed systems and methods that simultaneously grow a plurality of carbon nanotubes on substrates and across large wafers via employing vapor deposition of material on the surface of the substrate and fluid flow to aid in and direct the growth of the nanotubes in pre-specified locations and directions. In addition, the nanotubes created can be used as gas and chemical sensors, electronic switches, resonators, and non-volatile memory devices.

**Carbon Nanotubes (CNTs)**

CNTs can be utilized to form junctions with nano-meter scale areas with a solid-electrolyte, and the formation can be utilized in non-volatile memory devices, gas sensors, etc. By employing CNTs, small devices can result due to small contact areas associated with the CNTs (e.g., diameters in the range of 1-100 nm). CNT-wired memories can be utilized with computing devices due to their cross-bar geometry and nanometer scale since they can be manufactured with very high device densities in excess of 10 billion memory elements per square centimeter chip area, for example.

This research uses theory found in non-volatile memory devices, molecular electronics, and novel electronic materials.

**The AMANDA Research Group**

AMANDA (Advanced Metrology And Nano-Device Applications) is a new research group in the ECE Department focused on areas including non-volatile memory devices, microfluidics, microwave technologies for nanometrology, MEMS and NEMS, molecular electronics, and novel electronic materials (carbon nanotubes, and nano-particles) and devices.

AMANDA is looking towards the future of electronics by developing self-assembly and self-repairing circuits, non-destructive testing techniques, and new nanometrology tools for the evaluation and testing of these systems.

For more information on nanotube bridges, their applications, and other research fields pursued by the AMANDA group, please visit the group website at: http://www.ece.utah.edu/amanda

_Credit to Alton Parrish of "Nano Patents and Innovations" online:_
http://nanopatentsandinnovations.blogspot.com
ICO Prize Goes to Rajesh Menon for Nanolithography
Committee recognizes breakthrough achievement in nanolithography

Dr. Rajesh Menon, a USTAR Assistant Professor in the ECE Department, has won the 2009 International Commission for Optics (ICO) Prize for “breakthrough achievements in nanolithography.” A branch of nanotechnology, nanolithography helps fabricate tiny structures like semiconductor circuits.

A “young scientist” award, the ICO Prize is given annually to a person who has made a noteworthy contribution to optics before the nominee has reached the age of 40.

Menon’s research lies at the intersection of optics and nanotechnology with an emphasis on improving the spatial resolution of optics to the nanoscale (one billionth of a meter).

The smallest feature that can be patterned using light is limited to about half a wavelength. This far-field diffraction limit prevents visible light from resolving features below 200 nanometers.

Traditionally, scanning-electron-beam lithography (SEBL) has been a widely used method for beaming electrons across a surface to create very small structures for subsequent etching or other purposes. SEBL tends to be slow, expensive, and prone to placement errors. Light avoids all of these problems.

A major research goal of Menon’s has been to overcome this barrier. The ICO recognized Menon for his invention and development of Absorbance Modulation, which overcomes limitations of SEBL and is not limited by diffraction.

Menon’s Research Featured in Optics and Photonics News
“Towards Diffraction-Unlimited Optical Nanopatterning”

Bob Guenther, the guest editor of the issue, and a team of six volunteer editors have combed through the work of scientists from around the globe to identify 28 summaries that highlight the most exciting optics research to emerge over the preceding 12 months. One such summary chosen is that of ECE Assistant Professor Rajesh Menon and his groundbreaking work in nanophotonics.

For more info on Rajesh’s research, visit the Lab for Optical Nanotechnologies online: http://lons.utah.edu
Mike Scarpulla’s Research Featured in Optics Express
Glass nanoparticles can improve thin film silicon solar cells

In a recent issue of Optics Express, ECE Ph.D. candidate James Nagel and his adviser Prof. Mike Scarpulla have demonstrated a novel concept for improving the efficiency of thin-film silicon (Si) solar cells by employing the light scattering properties of embedded glass (SiO₂) dielectric nanoparticles.

Silicon solar cell technologies are promising for reducing the bulk material costs of photovoltaic devices while having reasonable power conversion efficiencies. Because of its natural abundance and non-toxicity, Si is an ideal material for GW- and TW-scale energy production.

Unfortunately, thin layers of Si absorb red and near-infrared light so poorly that thicknesses of a few hundred microns are required. Current research focuses on light trapping schemes which can make thinner Si solar cells more efficient by redirecting the light laterally and trapping it within the cell via total internal reflection.

Nagel’s concept of using embedded dielectric nanoparticles for light trapping was modeled using finite-difference time-domain (FDTD) computer simulations to determine that inserting such SiO₂ nanoparticles could increase the solar power absorbed within 1 micron-thick Si cells by up to 12%.

“These simulations represent only the tip of the iceberg in terms of what may be possible,” said Prof. Scarpulla. “However the real test is to actually make Si cells with embedded nanoparticles and test whether they actually are more efficient.”

Increasing light absorption by the most commonly used solar cell material could quickly increase the ratio of efficiency to cost ratio for one of the most promising renewable energy sources.

Read more online: http://scarpulla.eng.utah.edu

More Optics and Photonics Research at the U

Prof. Steve Blair oversees the Center for Microarray Technology, which is developing improved optical instrumentation and biochemical methods for medical research and clinical diagnostics. Focus areas include the detection of genetic mutations and DNA modifications.

Professor Blair’s group also focuses on nanophotonics. Applications of nanophotonic structures range from single molecule detection to increasing light emission efficiency of LED devices to solar energy harvesting.

Prof. Ajay Nahata is working on terahertz optoelectronics in the fields of plasmonics, metamaterials, ultrafast optics, nonlinear optics, guided-wave devices, and imaging.

Terahertz optoelectronics is a fast growing technology that has a wide range of applications, including communications, computing, biotechnology, spectroscopy of materials, sensing and medical imaging.
Since its inception, the Power Engineering program has received generous funding from various sources. In 2008, local organizations provided $230,000 in funding for the new program, including support from the Intermountain Power Agency, Rocky Mountain Power, Utah Rural Electric Association, Questar, Utah Associated Municipal Power Systems, the Utah Municipal Power Agency, and Reliable Controls.

The initial funding was quickly supplemented with research money from the University of Utah in the form of a Base Engineering Equipment Fund (BEEF) award from the College of Engineering totaling $66,000. The Intermountain Power Agency also provided a $15,000 equipment fund for the new Power Engineering Teaching Lab.

So far in 2010, the PEARL group has been awarded $106,000 from the Electronic Power Research Institute (EPRI) to investigate a battery management system for plug-in hybrid and all-electric vehicles.

Generous support for PEARL continues to promote the Department’s efforts to train a new generation of Power Engineers in Utah.

PEARL RESEARCH GRANTS AND FUNDING

PEARL RESEARCH PROJECTS OF INTEREST

- Developing a low-cost high-efficiency battery management system for vehicular applications.
- A low-cost single phase induction generator for residential applications.
- A novel grid-tied PV inverter with extended lifespan.

The two professors and a growing class of Ph.D. candidates and research assistants are contributing to the initial and continued success of the PEARL group and the new Power Engineering program at the University of Utah.

The PEARL Team

**Professor Marc Bodson**, founding member of the IEEE Power and Energy Society in Utah and former ECE Department Chair, contributes to PEARL’s research goals in the area of control systems. Marc’s specific research topics include the control of electric motors and generators, flight control systems, and active noise and vibration control.

**Professor Faisal Khan**, a new ECE Assistant Professor who joined the Department as part of the new Power Engineering initiative, brings years of research experience from the Electrical Power Research Institute. Faisal’s current research interests include a high-efficiency low-cost vehicle battery management system.
ECE Department Technical Open House Honors Students, Alumni

John Zrno Named Distinguished Alumnus

John M. Zrno (left) delivered the keynote address at the annual ECE Technical Open House held on April 1st, 2010.

Speaking from his personal experience in the telecommunications industry, John encouraged the graduating class of ECE students to work to apply their newly learned technical skills to solve practical problems.

John graduated from the department with his BS in EE in 1961.

Students Honored at Banquet

ECE seniors enjoyed a semi-formal banquet hosted in the Varsity Ballroom of Rice-Eccles Stadium to recognize the best group and individual senior projects.

Winners of the Best Group Project 2010

L-3 Communications Clinic Team, composed of Maja Sameric, Jeremy Browning, Matthew Gray, Rachael Yazzie, and Geoffrey Davis.

Winners of the Best Presentations 2010

Jacob Johns, Kristian Blomquist, Jason Carter, Andrew Paulsen, Joel Nelson, and Maja Sameric.

Special thanks to this year’s Clinic Program sponsors: Micron, Sandia National Labs, L-3 Communications, and Rocky Mountain Power.

Past Distinguished Alumnus Awards

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MEET AN INVENTOR DAY

On March 1st, 2010, hundreds of local high school students visited campus to meet our inventors and see how we work together to build many of the necessities and conveniences of modern life in the annual Meet an Inventor Day organized by Tau Beta Pi.

SUMMER PROGRAMS

Throughout the 2010 summer, the ECE Department is teaming up with various other departments in the College of Engineering to host summer programs designed to ignite the spark of curiosity in high school students for an engineering education.

The Entertainment Arts and Engineering Summer Program introduces students to 3D modeling and animation in computer design workshops.

Hi-GEAR for Girls is designed to expose 9th-12th grade female students to a variety of engineering and computer science careers with hands-on experiential learning and collaborative team projects.

The Utah Youth Summit gives young students the chance to contribute their innovative ideas on using state government resources to improve the quality of life in Utah to the state governor.

Outreach programs online: www.coe.utah.edu/k12

GIRL SCOUT ENGINEERING NIGHT

On February 18th, 2010, more than 100 Girl Scouts visited the College of Engineering to learn about modern engineering research and to explore potential career options with faculty and current students. The Society of Women Engineers invited the Girl Scouts to build circuits with blinking lights, to disassemble computers to learn about their parts, and to help design (and ‘patent’) an artificial heart valve.

ENTREPRENEURSHIP COMPETITION

The Utah Entrepreneur Challenge recognized the startup company Short Solutions, composed of students in the ECE Department, as the winner of the annual state-wide business plan competition.

The ECE students were awarded $40,000 in start-up funds to design and develop proprietary tools that allow automobile manufacturers, dealerships, and independent repair shops to quickly and efficiently diagnose and locate intermittent and permanent electrical faults in automobile wiring.
We are pleased to recognize the following individuals who contributed to the ECE Department between April 2009 and May 2010. We have made every effort to ensure accuracy, but if you have corrections or would like to report an omission, please contact Nathan Weston at weston@ece.utah.edu, or at (801) 585-9411.

Beulah Dalley
James ’69 and Aukje Dalley
Douglas ’84 and Denise Datwyler
Keith ’50 and Bonnie Dibble
Karl ’88 and Yana Edwards
Robert ’53 and Mary Jane Engman
Robert ’48 and Kathryn Goodfellow
Robert ’73 and Linda Grow
Melvin ’43 and Eugenia Herlin
Timothy ’04 and Michele Hollist
Jeffrey Johnson ’97, ’07
John ’69 and Kathleen Keller
James ’71 and Tanya Mahood

Steve McDaniel
Don ’56 and Sheron Olson
Harry ’63 and Maria Pappasideris
William Pohlchuck ’97
Neal Patwari and Cathleen Power
John ’58 and Manell Piccolo
Forrest ’70 and Rolayne Staffanson
John ’84, ’88 and Janae Urry
Harold ’59 and Roberta Vitale
David ’70 and Beverly Walton
Raymond ’76 and Karen Worth
Yun Cheng ’87 and Sheue Ching Yu

Corporations and Foundations

Dow Chemical Company Foundation
Engman Family Trust
Intermountain Power Agency
L-3 Communications
Mahood and Company
Micron
Micron Technology Foundation
MOXTEK

Pure Energy Solutions
Rocky Mountain Power
Sandia National Labs
UPRI Limited Partnership
Utah Valley Patent Services
XE Corporation
Xerox Foundation
Keep In Touch

Alumni are encouraged to update their information with the ECE Department.

Update your contact information online: www.ece.utah.edu/alumni_update

News (activities, honors, awards)

Position
Company Name
Cell
Email
Fax
City
State
ZIP
Address
Name
Graduation Year
Phone
Cell
Fax

Or complete and submit the following survey to:
The ECE Department
50 S. Central Campus Dr Rm 3280
Salt Lake City, UT 84112-9206