This year has been another exciting one in the Ritchie School. Enrollments in our undergraduate programs continue to grow, with this year’s incoming class of close to 200 students setting the record for the largest number of first-year engineering and computer science students. Total undergraduate enrollment this fall was 462 students, an increase of 30% over last year! Our graduate enrollments remain strong, making for a vibrant research-focused experience for all students.

Construction of the new building is well underway. John Greene Hall was demolished last spring to make way for the new facility, the site excavated, and the foundation is now being poured. The skeleton of the building is starting to emerge from the “big hole,” bringing with it a sense of excitement of great things to come. The project is still on track to open in Fall 2016, and will be one of the premier engineering and computer science buildings in the region.

As you will see from the many articles in the Newsletter, our faculty and students have been quite active in their respective research programs. This year saw the creation of two new NSF-sponsored Industry/University Cooperative Research Centers in the Ritchie School: the Center for Robots and Sensors for the Human Well-Being, and the Center for Novel High Voltage/Temperature Materials and Structures. The centers bring faculty, students, and industry partners together to collaborate on a variety of research problems. In addition, the bioengineering, unmanned systems and robotics, and power and energy research teams have collectively garnered over $3M in external funding to support their research this year, and a team of computer science students was selected as finalists in the 2014 E3 College Game Competition for their “Data Helix” game.

This year we received a number of extremely generous gifts totaling in excess of $6M, with over $4M designated for scholarships. The scholarships will be used to help increase the diversity of the undergraduate student body by providing financial assistance to women and domestic students of color. We greatly appreciate the gifts we receive from alumni and friends of the Ritchie School, and continue to seek your support as we close in on our goal of $8M to complete the funding for the new building. Your financial support is extremely important as it allows us to directly impact the educational experience of our students. Thank you.

On behalf of the Ritchie School faculty, staff and students, Happy Holidays and best wishes for a peaceful and productive 2015.

Michael J. Keables, PhD
Interim Dean
Donor Spotlight

by Kathryn Mayer

The University of Denver’s intensified focus on science and technology makes perfect sense to Robby Robb, a DU alumnus and former engineer who was the founding chairman of the board of the Denver School of Science and Technology (DSST).

This year, Robb and his wife, Barbara, did their part to help University of Denver students achieve success in the sciences: they donated almost $2 million to support scholarships for STEM students at DU. The gift gives special consideration to graduates of DSST, a charter school that allows underprivileged Denver kids to explore their interest in the sciences.

The Robbs’ gift, made in the form of a charitable remainder unitrust, was partially matched by the University. Those funds will enable the scholarship to be awarded to a student as early as Fall 2015.

The gift perfectly complements the University’s focus on STEM, illustrated most dramatically by a new 130,000-square-foot, $60 million building that will house the Daniel Felix Ritchie School of Engineering and Computer Science and the Knoebel Center for the Study of Aging. Construction began this summer on the building, which is expected to open in Fall 2016. The expansion also means the University will be able to grow its engineering and computer science student and faculty capacity by 30 percent.

Robby says his own passion for STEM was nurtured at the University of Denver. “My education from DU was the foundation that allowed me to have a very successful career in a number of areas,” Robb explains. “It allowed me to go into design engineering, into systems integration, into computers, and a wide range of areas. When I go into something new and different, I find that I draw from the basic education from DU.”
His education received at the University also came in handy when Robb was helping to create DSST, a network of charter schools within the Denver Public Schools system that focuses on science education and aims to prepare kids for college.

Thanks to his own STEM education, Robb worked for 20 years at Martin Marietta and Boeing in their engineering, production control and computer operations divisions. He then spent two decades working on private ventures before turning his focus to education. It was when he was serving as a University of Colorado Regent that Robb met David Greenberg, who was serving on the Colorado Commission on Higher Education and was just beginning to formulate the plan for the school that would become DSST.

Not long after that initial meeting, Robb was approached by Greenberg—who in 2012 became vice chancellor for institutional partnerships at DU—asking him to be part of DSST. Greenberg envisioned the concept as a national demonstration project “to prove that all public school students, regardless of background and economic status, could succeed at a very high level.”

Today, the DSST network serves close to 3,000 students on six campuses. More than 70 percent are students of color, and more than 65 percent are from low-income families. And every graduate has been admitted to a four-year college or university.

“I’ve always had this personal mantra that I wanted to make a difference that is a difference. It’s even written on a paper inside my medicine cabinet so I see it each morning,” Robb says. “I see this as a way to help others get the education and the opportunities to make a difference for themselves, their families and, in a larger sphere, the country. Because if we don’t have educated, trained people we won’t be able to sustain our economic positions. This helps everyone.”
Spotlight on Research

Amin Khodaei

Dr. Amin Khodaei (assistant professor, electrical and computer engineering) discovered his life work when he did an internship at a power company in the junior year of his undergraduate studies, so it’s no surprise his current research interests include power system operation and planning, computational economics, smart grids, and microgrids. He works with nine students (7 PhD and 2 masters) from the Ritchie School, and is currently the principal investigator of over $550,000 in projects, funded by the U.S. Department of Energy and National Science Foundation.

**Microgrids Design and Development:** Microgrids are small-scale power systems that can be deployed at electricity consumers’ premises to provide a local supply of electricity. As boosters of distributed generation, improved grid reliability, and the green energy economy, microgrids have been significantly deployed over the past few years and are anticipated to grow even more in the future.

Dr. Khodaei’s research is part of a project led by Chicago-based Commonwealth Edison (ComEd), one of the largest electric utility companies in the United States. It addresses the design and development of advanced microgrid controllers, which are aimed at efficiently managing a set of local distributed generation, energy storage, and demand resources. This research, which is funded by the U.S. Department of Energy, will be performed in the next two years in collaboration with leading authorities in this area, including: Illinois Institute of Technology, Argonne National Laboratory, Quanta Technologies, S&C Electric, Schneider Electric, OSI Soft, and Microsoft.

**Power System Resiliency:** Extreme weather events result in significant economic, social, and physical disruptions, and cause considerable inconvenience for residents living in disaster areas due to loss of electricity, water and communication. The electricity infrastructure, which is one of the most critical lifeline systems and is of utmost importance to our daily lives, is also impacted by these events.

Through modeling the impact of extreme weather events on continuous operation of power system components, Dr. Khodaei is developing proactive response schemes to expedite recovery of damaged components and minimizing the aftermath of these events, considering limitations on the budget and the repair crew. This research, Proactive Recovery of Electric Power Assets for Resiliency Enhancement (PREPARE), is funded by the National Science Foundation for three years.
Eva Håkansson’s life is all about cutting edge engineering. She is spending her days at the University of Denver as a mechanical engineering PhD student under the supervision of Dr. Maciej Kumosa, and as Marketing Director for the newly formed NSF-supported “Industry/University Co-operative Research Center for Novel High Voltage/Temperature Materials and Structures,” known as the “HVT Center.” The HVT Center is a result of Dr. Kumosa’s efforts, and currently has 11 industry members supporting projects on advanced materials from high voltage transmission lines to rocket engines. At night Eva builds the world’s fastest electric motorcycle in her garage—the “KillaJoule.” This 19 ft., 400 horsepower battery-powered beast has so far reached a speed of 270 mph with Eva as the rider, making her the world’s fastest woman on a motorcycle.

At a first glance, Eva’s PhD research about galvanic corrosion of high voltage transmission conductors and work with a research center seems to be as far as you can come from motorcycle racing, but Eva says that there is a lot of overlap. “First off, galvanic corrosion and batteries are just two sides of the same coin,” Eva says. “The chemical mechanisms that destroy high voltage conductors are the same chemical mechanisms that make a battery work. They are both electro-chemical systems. I often call it ‘destructive vs. beneficial’ galvanic corrosion. My understanding of batteries helped me to get started in corrosion, and my current knowledge in corrosion has helped me better understand how to get the maximum performance out of my batteries.”

There is also another large overlap between the two parts of her life—marketing. “Running a racing team is not much different from a research center,” Eva claims. “You, of course, have to produce results, that is always necessary. But if nobody knows you exist, the results don’t mean anything. You have to be visible, and you have to give your sponsors value for the money. If you don’t, the sponsors won’t stay.”
The DU Center: Collaborative Research: I/UCRC Industry/University Collaborative Research Center for Robots and Sensors for the Human Well-Being defines well-being as “optimal experience and functioning.” The Center’s objective is to develop technological advancements in robotics and sensing as they impact key areas of economic importance to the nation and the well-being of humans. Dr. Anneliese Andrews (professor, computer science) and Dr. Paul Rullkoetter (professor, mechanical and materials engineering) are co-directors of the Center. Nine additional faculty members are also contributing their expertise.

Human well-being touches many areas in which complex computer systems can be applied. For example, they enhance human well-being via medical improvements, such as socially assistive robotics and biomechanics; through improved infrastructure, such as weather prediction and analysis, power grids and power provision; through communication and data exchange, such as management of system networks and exchange of big data; and through cybersecurity, ensuring the correctness and privacy of data.
These areas also face great challenges in common. For example, computer vision and robotic manipulation for defense applications encounter similar challenges found in medicine and analytics. These challenges include the need for dependability, safety, and security. Additionally, they may share similar technology, e.g. the same algorithms used for surveillance in the defense industry are now used for cancer detection.

The Center’s research areas include:

**System Engineering Methodology for Robots and Sensors.** This work includes methods for improving robotic systems, system development and testing. Algorithms for robotic systems include decision making and collision avoidance.

**Medical Applications.** This work includes use of robotics and sensors for biometrics, pattern recognition (facial patterns, patterns of movement), and remote monitoring. Medical robotics include surgical robotics, robotics for rehabilitation and mental health monitoring.

**Infrastructure for Human Well-being.** This includes use of robotics and sensors for improving reliability and robustness of the infrastructure, including the power grid, agriculture systems, and communications grid.

**Cybersecurity for All Relevant Application Domains.** This is particularly important since so many systems and devices work wirelessly and thus are prone to cyber attacks.

**Intelligent Network Configuration and Big Data Transmission.** This includes configuration of networks to maximize data flow and allow maximum data across a network.

**Analytics.** Many relevant domains deal with analysis of large amounts of data, be that surveillance, satellite communication, or national security applications.

Dr. Andrews says the Center’s plans are to take the capabilities they have and look for industry partners whose needs will cause them to branch out to new capabilities and find new solutions. For more information, please contact Dr. Andrews at anneliese.andrews@du.edu or Dr. Rullkoetter at prullkoe@du.edu.
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### Anneliese Andrews
**Professor**

Dr. Andrews’ research interests center around software and system testing, quality and reliability with a heavy emphasis on empirical work including case studies and experiments.

### Scott Leutenegger
**Professor**

Dr. Leutenegger works in the field of humane games, a term coined at the University of Denver to encompass: 1) games for education; 2) games for health; and 3) games for change.

### Cathy Durso
**Lecturer**

Dr. Durso’s current research activities are in statistical analysis. She recently completed a review of the variability, stability, and bias of a statistical method used to evaluate teachers.

### Susanne Sherba
**Senior Lecturer**

Dr. Sherba teaches undergraduate and graduate software engineering courses, as well as introductory courses for both majors and non-majors. She has presented her experiences teaching online courses to the DU community and at several regional conferences.

### Mario Lopez
**John Evans Professor**

Dr. Lopez’s research interests are in computer graphics, multidimensional databases, algorithms, computational geometry, spatial and geographic information systems, and computer music.

### Nathan Sturtevant
**Assistant Professor**

Dr. Sturtevant’s primary research involves state space search techniques, including combinatorial search, path planning, and adversarial search, as well as large-scale parallel search for building heuristics or solving domains. He applies this research to applications from planning, robotics, and games.

### Chris GauthierDickey
**Associate Professor**

Dr. GauthierDickey’s research is broadly defined as creating and developing cheat-proof, peer-to-peer protocols for large-scale interactive applications, such as multiplayer games and multiuser augmented realities.

### Michael Goss
**Lecturer**

Dr. Goss’ interests include computer graphics, geographic applications, and parallel and distributed computing. His areas of research have included computer graphics pipeline architecture, graphics for real-time simulation, volume rendering, image-based rendering, and telepresence.

### Jeffrey Edgington
**Lecturer**

Dr. Edgington’s research work is in computer science education and games for education.

### Matthew Rutherford
**Associate Professor**

Dr. Rutherford’s research portfolio includes: the development of advanced controls and communication mechanisms for autonomous aerial and ground robots; testing and dynamic evaluation of embedded, real-time systems; and the development of complex mechatronic systems (mechanical, electrical, and software).

### Rinku Dewri
**Assistant Professor**

Dr. Dewri’s research interests are in the design of usable solutions for privacy-sensitive applications. His current projects include: leveraging processor advances for privacy-preserving mobile search, privacy-preserving record linkage of distributed health data, and delivering sensitive data access trends to the non-expert.

### Ramki Thurimella
**Professor & Chair**

Dr. Thurimella’s research interests are in algorithm design and information security and privacy. Current projects include the application of data mining techniques to intrusion detection, migrating long-running TCP connections (SMTP, FTP, HTTP etc.) in a client transparent, and tracing Internet worms to their origin.
Ron DeLyser
Associate Professor

Dr. DeLyser’s research interests are in engineering education pedagogy, engineering program accreditation, and outcomes-based assessment for both engineering programs and general education.

George Edwards
Lecturer

Dr. Edwards’ areas of research are in communications and digital signal processing. He has researched and developed algorithms for cellular communications and geolocation signal analysis.

Robert Whitman
Senior Lecturer

Dr. Whitman’s research interests are in speech analysis and coding, for application in text-to-speech and speaker recognition systems.

Mohammad Matin
Associate Professor

Dr. Matin’s research interest is in optoelectronic devices (such as sensors and photovoltaic), radio over fiber (RoF) communications, ultra-wideband RoF for wireless communications, digital, optical & bio-medical signal & image processing. He is also interested in engineering educational pedagogy.

Amin Khodaei
Assistant Professor

Dr. Khodaei’s research interests include power system operation and planning, power system resiliency, computational economics, microgrids, and smart electricity grids.

Kyoung-Dae Kim
Assistant Professor

Dr. Kim’s research interest is in developing theories, tools, and software for autonomous, reliable, and cooperative dynamical systems. Particular research projects include collision-free autonomous transportation, human-machine interface and cooperation, and fault-tolerant control for fail-safe operation.

David Gao
Associate Professor

Dr. Gao’s research interests are in power and energy systems, including renewable energies, microgrid, distributed generation, smart grid, power delivery, power electronics application, power system protection, power system restructuring, and hybrid electric vehicles.

Margareta Stefanovic
Associate Professor

Dr. Stefanovic’s research interests are in the areas of adaptive and intelligent systems and control, networked control, wind energy, and unmanned systems.

Kimon Valavanis
John Evans Professor & Chair

Dr. Valavanis’ research interests span the areas of system theory, intelligent control, distributed intelligent systems, robotics and automation, navigation and control of unmanned systems, cooperative multi-robot teams, integrated control and diagnostics, formation control and mathematical methodologies for designing intelligent machines.

Jun ‘Jason’ Zhang
Assistant Professor

Dr. Zhang’s research expertise is in signal and information processing, embedded systems and implementation-aware algorithms, and agile multi-modal sensing. Currently, his funded research includes data-driven methods-based situation awareness, intelligent power systems, and multi-modal human motion measuring and activity recognition.
Breigh Roszelle
Lecturer

Dr. Roszelle’s research interests are in the field of biofluid mechanics, especially the fluid mechanics of the vascular system, including diseased states and the effects of interventional medical devices.

Matt Gordon
Professor & Chair

Dr. Gordon’s research areas include numerical and experimental plasma physics, chemical and physical vapor deposition, electronic packaging, and bio-medical engineering.

James ‘Chuck’ Wilson
John Evans Professor

The DU Aerosol Group designs, builds and operates instruments and sampling inlets used to study the origins, fates and impacts of microscopic airborne particles (aerosols), which harm human health, degrade visibility and impact stratospheric ozone depletion and climate change.

Ali Azadani
Assistant Professor

Dr. Azadani’s research interest encompasses cardiovascular mechanics, heart valve engineering, and biomechanics of trauma.

Peter Laz
Professor

Dr. Laz’s research is focused in orthopaedic biomechanics and materials, and involves the application of probabilistic methods to assess the contributions of uncertainty.

Maciej Kumosa
John Evans Professor

Dr. Kumosa’s research interests include the experimental and numerical multiscale analysis of advanced materials for electrical and aerospace applications subjected to extreme in-serve conditions. He is the Director of the Research Center (I/UCRC) for Novel High Voltage/High Temperature Materials and Structures.

Yun-Bo Yi
Associate Professor

Dr. Yi’s research includes: thermal-mechanical stabilities in high speed sliding systems; damping mechanisms in MEMS/NEMS devices; computational modeling of multiscale heterogeneous materials; percolation theories and applications; and finite element analysis.

Jason Roney
Lecturer

Dr. Roney’s research interests include work in the thermal-fluid sciences with emphasis in computational and physical modeling and simulation. His current research interests are in air quality, wind and renewable energy, near-space vehicles, aerosols, and boundary layer flows.

Bradley Davidson
Assistant Professor

Dr. Davidson’s research focuses on understanding human movement in healthy and patient populations using in-vivo experimental measurement and musculoskeletal modeling. Specific applications include muscle activation and biomechanics of spinal manipulation therapy and geometric modeling of intervertebral kinematics.

Corinne Lengsfeld
Professor

Dr. Lengsfeld specializes in meso- and micro-scale fluid systems. Her work includes biopharmaceutical stability, inhaled aerosols and fluid system optimization. She also serves as the Editor for the journal Atomization and Sprays.

Paul Rullkoetter
Professor

Dr. Rullkoetter’s research is in developing computational models to evaluate the performance of orthopaedic implants and influence implant design. Current modeling efforts include high fidelity models of the knee, spine, hip and shoulder, and whole-body musculoskeletal modeling.
SNAPSHOT

30.5% increase Undergraduate Enrollment

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