

# UAHuntsville

THE UNIVERSITY OF ALABAMA IN HUNTSVILLE

UAHuntsville College of Engineering

Fall 2012

Engineering **matters...**

Engineering **happens...**

Engineering **works...**

Engineering *the Future...*

# CHARGER ENGINEERING

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## CHARGER ENGINEERING

The College of Engineering at the University of Alabama in Huntsville publishes news and information on current research, academic programs, and service annually. To reproduce material contained in this newsletter, please contact the College of Engineering Dean's office at:

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## CHARGER GIVING

Friends and alumni of the College of Engineering can have a major impact on our mission by providing financial support and resources that will contribute to the College's strategic research and educational goals. Consider giving to support both undergraduate and graduate student scholarships, to fund faculty endowments, to improve educational programs, and to enhance research facilities.

To learn more about different options for giving to the College of Engineering, please contact the Engineering Dean, Prof. Shankar Mahalingam at Shankar.Mahalingam@uah.edu or 256.824.6474 or the Vice-President for Advancement, Mr. Robert Lyon at Robert.Lyon@uah.edu or 256.824.6501

## COLLEGE OF ENGINEERING

Professor Shankar Mahalingam  
*Dean of Engineering*  
*Mechanical and Aerospace Engineering (MAE)*

Professor Emil Jovanov  
*Associate Dean for Graduate Education and Research*  
*Electrical and Computer Engineering (ECE)*

Professor Jennifer English  
*Associate Dean for Undergraduate Affairs*  
*Electrical and Computer Engineering (ECE)*

Professor Chien-Pen Chen  
*Chair, Chemical and Materials (CME)*

Professor Houssam Toutanji  
*Chair, Civil and Environmental (CEE)*

Professor Robert Lindquist  
*Chair, Electrical and Computer (ECE)*

Professor James Swain  
*Chair, Industrial and Systems Engineering and Engineering Management (ISEEM)*

Professor Keith Hollingsworth  
*Chair, Mechanical and Aerospace (MAE)*

## BECOME A CHARGER

### Faculty:

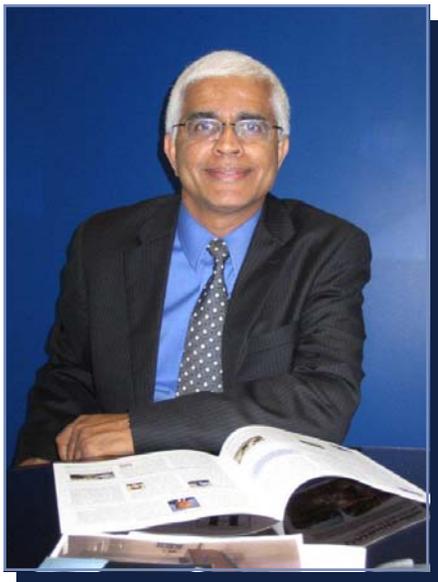
The College of Engineering is currently seeking tenure and tenure-track positions in most departments. For more information, go to [www.uah.edu/engineering](http://www.uah.edu/engineering) and go to Faculty Search 2012. UAHuntsville is an affirmative action, equal opportunity institution.

### Graduate Students:

The College of Engineering offers M.S.E. and Ph.D. degrees in a broad range of engineering disciplines. College faculty support strong research programs to support student research projects. For more information on graduate programs, go to [www.uah.edu/engineering](http://www.uah.edu/engineering).

### Undergraduate Students:

The College of Engineering offers the B.S.E. in eight ABET-accredited programs: Aerospace, Chemical, Civil, Computer, Electrical, Industrial & Systems, Mechanical and Optical. Undergraduate students have numerous hands-on opportunities including nationally recognized engineering teams, undergraduate research, and the cooperative education and internship programs. For more information go to [www.uah.edu/engineering](http://www.uah.edu/engineering).



## MESSAGE FROM THE DEAN

It is indeed my pleasure to share with you our 2012 Newsletter. I am privileged to report on some of the extraordinary achievements of our faculty, students, and alumni over the past year.

The college of engineering is continuing its focus in pursuing research in the areas pertaining to three of the National Academy of Engineering Grand Challenge problems. These include securing cyberspace, restoring and improving urban infrastructure, and enabling tools for scientific discovery. This past year, we initiated a focus on energy storage systems. All of these research thrusts address large complex systems that require both experimental and computational tools to develop solutions. We are particularly delighted to welcome four outstanding faculty members to our College in the areas of propulsion, energy, optics, and structural engineering. You can learn more about them in this newsletter.

In the 2011-2012 year, thanks to our dedicated staff and faculty, 287 BSE, 140 MSE, and 16 Ph.D. degrees in engineering were awarded. What sets our graduates apart is the wealth of opportunities they engage in both inside and outside the classroom. For example, a team of chemical engineering students placed 8<sup>th</sup> in a regional ChemE car competition. This year a group of Electrical Engineering students achieved a milestone with the 50<sup>th</sup> High Altitude Balloon Launch. An interdisciplinary team of engineering and nursing students won the 2012 SAIC Technology Challenge “Achieving the Dream: Building the Hospital of the 21<sup>st</sup> Century.”

Professor Jeff Evans received the highly prestigious National Science Foundation (NSF) CAREER Award in support of his research on the mechanical behavior of nickel and nickel-based superalloys under extreme environmental and thermomechanical conditions. Our enterprising engineering students associated with the Space Hardware Club put together a successful “CubeSat” proposal. As a result, their satellite that is being designed, built, and tested at UAHuntsville, with financial support provided by the Alabama Space Grant Consortium, is scheduled for a NASA flight in 2013-2014. Professor C. P. Chen was selected as an Associate Fellow of the American Institute for Aeronautics and Astronautics (AIAA) in recognition of his longstanding contributions in spray combustion. Under Professor Kate Leonard’s guidance, Civil Engineering student Jacqueline Marriott and her colleagues designed and built a water wheel in support of Huntsville’s Burritt on the Mountain Museum’s efforts to promote sustainability. We are particularly proud to report that Prof. Robert Skelton (MS in Electrical Engineering, 1969) was elected to the National Academy of Engineering in recognition of his pioneering research in tensegrity, an area of research that combines the disciplines of structures and controls. It is indeed gratifying to note that he gives credit for his success to our Distinguished Professor C. D. Johnson. Professors Sam Gholston and Dawn Uteley have been funded by the Alabama Department of Transportation (ALDOT) to develop a mentor-protégé program in support of disadvantaged business enterprises to help grow their business capabilities.

These are just a few examples of the amazing activities and accomplishments featured in our second *Annual College of Engineering Newsletter*. Once again, I am pleased to express our appreciation for the strong support we enjoy from our University leadership, academic colleges and research centers on our campus, the Huntsville community, federal, state, and corporate research and scholarship sponsors, our students and their families, our alumni, and our friends of the College and University.

Best regards,

A handwritten signature in black ink, reading "Shankar Mahalingam". The signature is written in a cursive, flowing style.

Shankar Mahalingam  
Dean and Professor of Mechanical and Aerospace Engineering  
October 2012

## Pulsed Power Generation

The "Charger-1 Pulsed Power Generator" is being assembled at UAHuntsville's Aerophysics Research Center on Redstone Arsenal. **Prof. Jason Cassibry** is leading a team of researchers from UAH, The Boeing Company, and Marshall Space Flight Center to repurpose a facility originally built for nuclear weapons research into a test facility for a spacecraft propulsion system based on nuclear fusion. The apparatus was built for the Defense Threat Reduction Agency and was decommissioned after the work for which it was built ended.

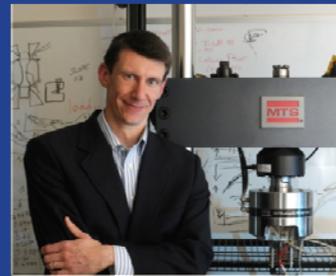


Prof. Jason Cassibry

UAHuntsville was informed of its availability in 2009 and work to assemble a research team and acquire the 50-ton device began. The facility will produce a powerful, but extremely brief, pulse of plasma created by an equally brief nuclear fusion reaction. An engine producing these pulses could propel a spacecraft over interplanetary distances at great speeds. Such a propulsion system could reduce a trip to Mars from six months to six weeks.



## NSF CAREER: Metal Madness



Prof. Jeffrey Evans

This past year Prof. **Jeffrey Evans** received the prestigious National Science Foundation (NSF) Faculty Early Career Development (CAREER) Award.

Prof. Evans' research program will investigate the influence of extreme environmental and thermo-mechanical conditions on the mechanical behavior of nickel and nickel-based superalloys. Creep deformation, oxygen diffusion, and crack tip oxidation are not well understood under these conditions. The educational outreach component of his CAREER activities is called "Metal Madness". This program, aimed at middle-school classrooms, will present basic knowledge in what metals are and how they behave. The program is targeted for the northern Alabama region.

Prof. Evans joined UAHuntsville after receiving his Ph.D. from the University of Arkansas in 2008. In 2010, he received the Keith J. Miller Young Investigator Award from the ASTM Committee on Fatigue and Fracture.

## Real-Time Radar Data Compression



Prof. W. David Pan

On July 12, 2012, for the first time, compressed weather radar data from a US Navy ship while participating in Rim of the Pacific exercises, was transmitted in real-time to the Fleet Numerical Meteorology and Oceanography Center in Monterey, CA. This task was achieved in part by the efforts of ECE Prof. **W. David Pan**.

As an ONR summer faculty fellow, Prof. Pan visited the Marine Meteorology Division of the NRL, where a meteorological radar data assimilation system was being developed to provide environmental information for enhancing the safety of ship and aircraft operations. A technical challenge was that radar data file sizes were too large given the operational bandwidth of the ships' communication systems. As an expert in data compression, he worked with a team of NRL scientists to develop a novel radar data compression algorithm that could reduce file sizes by a factor of forty. These collaborations resulted in development of software for efficient compression and decompression of weather radar data. These products will significantly enhance the US Navy's ability to detect hazardous weather conditions and assist decision makers in ship and flight planning and operations.

## UAH part of UTC Consortium

The Civil and Environmental Engineering (CEE) Department has joined nine other universities in the federally competitive consortium known as the National Center for Freight and Infrastructure Research and Education (CFIRE). CFIRE is a Tier 1 University Transportation Center (UTC) funded by the US Department of Transportation Research and Innovative Technology Administration. The consortium, lead by the University of Wisconsin-Madison, was one of ten selected programs from over forty proposers.



Prof. Michael Anderson

The theme of the CFIRE consortium is *Making Multimodal Freight Systems Work for Economic Recovery and Quality of Life*.

CEE **Prof. Michael Anderson** leads the research team from UAHuntsville. The UTC will focus on freight related research in the the central portion of the country linking the southeast and midwest. The department will receive funding to study the routing of hazardous freight, short-line railroads and the impact of the Panama Canal Expansion. The CFIRE consortium's annual budget is approximately \$3.5 million

## Department News



Prof. Chen

CME Prof. and Chair **Chien-Pin Chen** has been selected as an AIAA Associate Fellow and was honored at the 50th AIAA Aerospace Sciences Meeting held in January 2012 in Nashville, TN. To be selected as Associate Fellow, an individual must be an AIAA Senior Member with at least twelve years professional experience and be recommended by a minimum of three current Associate Fellows.

CPE Profs. Emil Jovanov and Aleksandar Milenkovic were recently awarded a NSF MRI grant for their mHealth project. This project will support the creation of a multi-tiered computing infrastructure pioneered at UAHuntsville. The



Prof. Jovanov

mHealth infrastructure will enable the investigators to explore critical design issues in next generation wireless wearable body area networks for health monitoring including their functionality, reliability, and energy-efficiency.

CME Prof. James E. Smith, Jr. was a Visiting Scholar to Shandong University in China. A comprehensive university, Shandong University attracts top students from across China and from about 30 countries. Prof. Smith taught Process Control Systems at Shandong University as part of their 2012 "Curriculum Internationalization Program" (CRP).



Prof. Smith

ISEEM Prof. Dawn Utley has been



Prof. Milenkovic

working with NASA's MSFC to examine informal systems engineering processes related to the Space Launch System (SLS). The overall intent is to study the systems engineering process and collect best practices to facilitate an affordable design using SLS as a test-bed for theory.



Prof. Utley

ISEEM Profs. Utley and Sampson Gholston, with funding from the AI Dept. of Transportation, are developing a Mentor-Protégé Program to provide guidance and training to Disadvantaged Business Enterprises to grow their business capabilities. The goal is to assess the state of the participant's business maturity and then to provide resources to improve their ability to write winning proposals.



Prof. Gholston

## Alumni Pride

A true measure of the quality of a college and its programs can be seen by the accomplishments of its graduates. Whether our graduates' terminal degrees are at UAHuntsville or elsewhere, the College of Engineering takes great pride in the achievements of our alumni.

**Dr. Robert Skelton** (MS'69) was elected to National Academy of Engineering in 2012 for his outstanding contributions to engineering research and pioneering of new fields of control technology. Election to the Academy is one of the highest distinctions accorded to an engineer. Robert Skelton is a leading theorist, whose work combines the disciplines of structures and controls.



Dr. Skelton

His research has focused on unifying structures and controls through a discipline called tensegrity. The term, derived from tension and integrity, describes combinations of strings and rods of various materials and sizes, assembled to create deformable bridges, buildings and other alternatives to current structural technologies. Prof. Skelton gives credit to ECE Professor C. D. Johnson in for his teaching and guidance. Prof. Skelton earned a Ph.D. at UCLA and is now a professor emeritus of the Department of Mechanical and Aerospace Engineering at University of California at San Diego.

**Mr. Steve Hill** (BSE'87) was awarded the 2012 Russell G. Brown Executive Leadership Award for excellence in leadership and entrepreneurship. In 1989, he started a

high tech firm called AEgis Technologies with co-founder Bill Waites. AEgis provides advanced technology and expert consulting services to customers around the world and has grown to over 250 employees with yearly revenues in excess of \$50 million. AEgis was awarded the 2012 Small Business of the Year and named in the Top 20 Best Places to Work in 2012 by the Huntsville/Madison County Chamber of Commerce. Through a partnership between Aegis and UAHuntsville, Mr. Hill will advance STEM education in the Tennessee Valley via a new initiative called TESSA (Technology, Engineering and Science Summer Academy).



Mr. Hill

## New Tenure-Track Faculty at UAHuntsville



**GEORGE NELSON** | Assistant Professor, Mechanical and Aerospace Engineering Department

Prof. Nelson is the first hire in the Department's new energy focus. He specializes in the investigation of mass and charge transport in fuel cells and batteries. Prof. Nelson's broader interests include transport phenomena, energy storage and conversion devices, sustainable energy systems, and multi-scale modeling and analysis. A Georgia native, he received B.S., M.S., and Ph.D. degrees in Mechanical Engineering from the Georgia Institute of Technology. Prof. Nelson is joining us after three years as an Assistant Research Professor in the Mechanical Engineering Department at the University of Connecticut, a position he has held since completing his Ph.D. in 2009.



**K. GABRIEL XU** | Assistant Professor, Mechanical and Aerospace Engineering Department

Prof. Xu is an experimentalist in plasma science as applied to propulsion, energy, materials processing, and combustion. He joins us, and the Propulsion Research Center, to continue our traditional focus in spacecraft propulsion and energy systems and to expand our capabilities in the broader area of plasma science and technology. Prof. Xu is a St. Louis native and he received his B.S., M.S., and Ph.D. degrees in Aerospace Engineering from the Georgia Institute of Technology. As an undergraduate, Prof. Xu was a Space Scholar at the Air Force Research Laboratory and an intern with Boeing. As a graduate student, he was a research assistant in the High-Power Electric Propulsion Laboratory at Georgia Tech.



**YING CHENG LIN** | Assistant Professor, Civil and Environmental Engineering Department

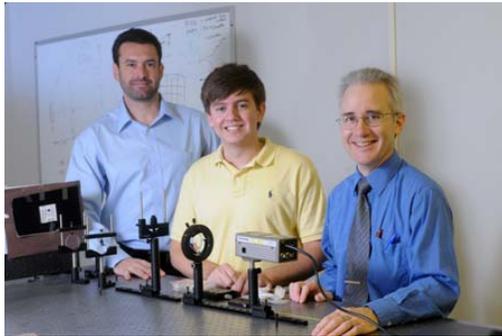
Prof. Lin's research areas include behavior and design of steel structures, seismic performance-based design, nonlinear modeling and analysis, and reliability analysis of structural systems. He received the Best Oral Presentation Award at the 8th International Conference on Urban Earthquake Engineering in 2011 and received the P.C. Rossin Doctoral Fellowship, College of Engineering and Applied Science at Lehigh University in 2010 and 2011. Prof. Lin earned his BS in civil engineering and MS in structural engineering from National Taiwan University. He received his Ph.D. in Civil Engineering from Lehigh University in 2012. His PhD research was part of the NSF NEESR-SG project on self-centering damage-free seismic-resistant steel frame systems.



**PATRICK REARDON** | Assistant Professor, Electrical and Computer Engineering Department

Prof. Reardon began his career in industry working in optical systems design for military, medical and commercial entities. He has been at the UAHuntsville Center for Applied Optics for the past 14 years for which he currently serves as Director. He performs optical design, fabrication, and metrology research for numerous DoD, aerospace, and commercial programs. His designs have encompassed the deep UV through THz, and from microoptical to large space-borne telescopes. He has over 50 publications, 3 awarded patents, and 1 pending patent. Prof. Reardon received his B.S. in Physics from DePaul University (1986), then his M.S. and Ph.D. in Physics from UAH (1990 and 1993, respectively).

## Hilbert Optical Design Winner



**Josh Walters**, ECE graduate student, won the 2012 Robert S. Hilbert Optical Design Competition which is known as the most prestigious student optical design competition in the US.

For this competition Josh modeled a 5x6, 1 mm pitch lenslet array as non-sequential surfaces in Code V to explore imaging cross-talk scenarios using a single model construct. The alternative system developed by Josh alleviates the cross-talk problem, as well as the loss of effective aperture and field-of-view inherent in the conventional solution, via the implementation of an arrangement of polarizers and spectral filters. As a bonus, the system design also turns this thin sensor into a spectro-polarimetric imager.

Mr. Walters, who has just completed an MS in Electrical Engineering, accepted a position with Torch Technologies in Huntsville. Josh also received his B.S.E. in Optical Engineering from UAHuntsville. Josh's advisor, **Prof. Brian Robinson**, is a Researcher Scientist in the Center for Applied Optics. He provided the research topic and guided him in the systematic approaches for the project. Prof. Patrick Reardon, Director of the CAO, provided Josh instruction in the use of CodeV. In addition to the national recognition, the award includes a \$1500 cash prize

## ORNL—Internship

Undergraduate CME student **Julie Thomas** has been selected to participate in the Science Undergraduate Laboratory Internships program at the Oak Ridge National Laboratory in Oak Ridge, TN. Julie will participate in a research project to assess novel catalytic materials for biofuel applications. Through hands-on laboratory work and data interpretation, she will learn and apply methodologies to discover relationships between synthesis parameters, structures, and performance of catalytic materials. The ultimate goal of the study is to obtain fundamental insights relevant to the development of chemical catalysts tailored to biomass-derived liquids.



## TBII Fellow-Claude Bridges IV



The College of Engineering proudly recognizes Mr. Claude S. Bridges IV for receiving one of only forty Tau Beta Pi graduate fellowships awarded for 2012-13.

A native of Ardmore, Alabama, Claude graduated from UAHuntsville in May of 2012 with a BSE in Industrial and Systems Engineering, a BS in Mathematics and a minor in Mechanical and Aerospace Engineering. He was inducted into Tau Beta Pi, where he served as Treasurer. In 2011, he was named a Tau Beta Pi Scholar and received a scholarship— one of approximately 150 awarded nationwide. He was also inducted into the Phi Kappa Phi, Alpha Pi Mu, and Alpha Lambda Delta honor societies. He received the Mathematical Sciences Department Honors Award for 2010-2011 and was recognized as the Most Outstanding Engineering Student for 2012. He was also a member of the Society of Manufacturing Engineers (serving as Vice-President), American Society of Mechanical Engineers, the Math Club, and the Institute of Industrial Engineers (also serving as Vice-President). He was a College of Science Ambassador and he was a staff writer and photographer for the UAHuntsville newspaper.

## Ford Foundation Fellowship



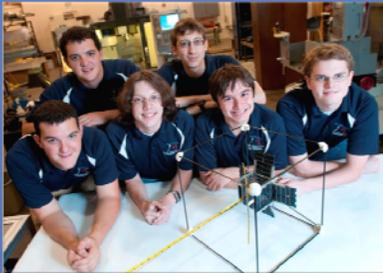
MAE graduate student **Shushannah Smith** has been selected to receive the highly prestigious 2012 Ford Foundation Pre-doctoral Fellowship. This fellowship is sponsored by the Ford Foundation and administered by the National Research Council of the National Academies. The pre-doctoral fellowship provides funding for three years of Ph.D. study. Approximately sixty fellowships are awarded nationwide to students in a wide variety of the academic fields. Her application to the Foundation was prompted by a class assignment in proposal writing in **Prof. Robert Frederick's** graduate class, *Advanced Readings in MAE*.

## EWRI Student Day Honors

At the 2012 World Environmental & Water Resources Congress of the Environmental & Water Resources Institute (EWRI), several UAHuntsville students were recognized. In the Undergraduate Division, SANPAC honored CME student **Sabiha Runa** with third place for her summer research project on the Flint River Watershed with CEE **Prof. Kate Leonard**. For the Graduate Division, recent MSE graduate **Hernando Gauto** was awarded third place for his work with optimizing vertical wind turbine technology.

## NASA to Launch UAH Satellite

UAHuntsville is one of 33 universities selected by NASA to fly a small "CubeSat" satellite aboard a rocket in 2013-2014. The satellite, resembling a large Rubik's cube coated with solar cells, was designed and built by the Space Hardware Club. This college-wide student-volunteer organization



designs, builds, and tests flight hardware for high-altitude balloons and the CanSat competition. The group is led by brothers **Eric and Mark Becnel**, both MAE students. Support for the project is provided by the Alabama Space Grant Consortium.

## CHARGER IEEE



The **Charger IEEE** group traveled to the 2012 IEEE SouthEast Con in Orlando, where they competed in the Hardware competition. The students designed a computer controlled robotic system that would traverse a course and receive input from course for directions.

They placed 18th out of over 40 teams.

## UAH Moonbuggy takes Top Prize in 2012

A team of nine MAE students received the top prize at the NASA Great Moonbuggy Race held in April 2012 at the United States Space and Rocket Center in Huntsville. The MAE team scored a triple win: they won the closed-course race in the university division, and they received top honors in the "Best Design Report" and "System Safety Challenge" competitions.

Members of the American Institute of Aeronautics and Astronautics judged the design competition and requested that the MAE team's winning report be posted on the NASA Moonbuggy website as an example to future competitors. As a result of the triple win, the team received over \$3700 in prize money. The Moonbuggy team was advised by **Dr. Christina Carmen**. The team was supported by the Alabama Space Grant Consortium and the University.



## UAH Concrete Canoe Team wins again.

The UAH Concrete Canoe Team competed in the 2012 Southeast Conference Concrete Canoe Competition held in Tallahassee on March 22nd-24th. Team UAH finished a close second to the University of Florida in a field of nineteen entries. UAH finished 1st in the design paper, 2nd in the product, and 3rd in the races. The UAH Concrete Canoe Team will seek their sixth national title in 2013.



## UAH ChemE Car wins 8th Place

In April 2012, undergraduate students from the UAHuntsville chapter of the American Institute of Chemical Engineers participated in the regional ChemE Car competition held at Clemson University.

The UAHuntsville team bases the design of the *Watter-Bug* on hydrogen fuel cell technology. They placed 8th in the field of 20 teams from the region .



## InSPIRESS : Inspiration for the next Generation of Engineers

High school students in the Innovative Project for the Increased Recruitment of Emerging STEM Students (InSPIRESS) program are asked to design a scientific payload to accomplish a supplemental project that will be included on the IPT designed spacecraft. InSPIRESS is the brainchild of **Dr. P.J. Benfield** (Ph.D. ISE 2004) and **Dr. Matt Turner** is now in its third year.

There has been phenomenal growth in the InSPIRESS program over the past three years, growing from 27 students in 2009 to over 400 students from eighteen high schools. The high schools are from the North Alabama area to southern Tennessee and even as far a Texas.

The plan for the academic year 2012-2013 adds three additional high schools (Muscle Shoals, Florence, and Hanceville), bringing the total number of high schools to 21 and the projected student participation for next year to 480 .