engineering news

VirginiaTech College of Engineering

inside

VIRGINIA TECH COLLEGE OF ENGINEERING SPRING 2014

Virginia Tech positioned to lead new industry of unmanned aircraft

Virginia Tech leaders, along with counterparts in New Jersey, welcomed a late December approval by the Federal Aviation Administration to operate a test site to integrate unmanned aircraft into the national airspace.

With plans for the University of Maryland to join the partnership, efforts to introduce the safe and responsible use of unmanned aerial vehicles to the nation will be well-represented in the mid-Atlantic.

"Virginia Tech and its partners are positioned to lead growth in a dynamic, new industry," said Virginia Tech President **Charles W. Steger** in December. "Integrating unmanned aircraft into the national airspace is a great responsibility, one that our faculty members and government, university, and industry partners take very seriously. We are ready to meet this challenge."

In September, Maryland, New Jersey, and Virginia expressed their commitment to jointly support test-site infrastructure in a letter to the Department of Transportation and the Federal Aviation Administration.

The FAA has until 2015 to develop regulations aimed at limiting the privacy and safety concerns associated with unmanned aircraft. Congress called for the establishment of six national unmanned aircraft system research and testing sites through the FAA Modernization and Reform Act of 2012.

While much of the testing to date has been conducted under defense programs, continued work on the integration of unmanned aircraft into the national airspace will be implemented through a combination of federal, state, and local government resources, along with academic institutions and private industry.

New Jersey and Virginia submitted a joint proposal led by Virginia Tech as the Mid-Atlantic Aviation Partnership, which unites academic, industry, state government, and economic development organizations.

The University of Maryland, College Park, was the lead agency in the Maryland application for an FAA test site, bringing together a similar consortium of groups and test ranges.

After submitting the applications, the three universities agreed to work as a united team to enhance the region's competitive position in the event that either or both proposals were selected by the FAA.

The Commonwealth of Virginia also announced in late 2013 it would

See Drones, page 8

Kevin Kochersberger *(left), director of the Unmanned Systems Laboratory at Virginia Tech, has been a leader in early research and design of unmanned vehicles such as this 250-pound helicopter (above).*

Boroyevich named to National Academy of Engineering

Dushan Boroyevich, the American Electric Power Professor of Electrical and Computer Engineering, was one of 67 new members elected in February to the National Academy of Engineering for 2014. He was honored for his advancements in control, modeling, and design of electronic power conversion for electric energy and transportation.

"As **Fred Lee** was my academic adviser, I thought mine was a long way off. I didn't think this would happen for the next five to 10 years," said Boroyevich, co-director of the Virginia Tech's Center for Power Electronics Systems along with Lee, who was inducted into the academy in 2011.

Boroyevich is a Fellow with the Institute of Electrical and Electronics Engineers and a recipient of the organization's William E. Newell Power Electronics Technical Field Award, and a past president of its Power Electronics Society. He received the Award for Outstanding Achievements and Service to Profession by the European Power Electronics and Motion Control Council, six prize paper awards, and several awards for excellence in research and teaching at Virginia Tech.

Boroyevich

His research has focused on multi-phase power conversion, electronic power distribution systems, modeling and control, and multi-disciplinary design optimization. Boroyevich has advised more than 79 doctoral and master's students, and co-authored with them more than 650 technical publications. He is a longtime Hokie, even before joining the faculty in 1990. He earned his doctorate from Virginia Tech in 1986.

Under the leadership of Boroyevich and Lee and working in partnership with more than 80 companies, the Center for Power Electronics Systems has become the most renowned power electronics research and education center in the world, boasting more than 20 faculty members and more than 200 research students on staff, during the its years under the National Science Foundation.

Nayfeh receives Franklin Institute Medal

University Distinguished Professor Emeritus **Ali Hasan Nayfeh**, of the Department of Engineering Science and Mechanics, was awarded the 2014 Benjamin Franklin Medal in Mechanical Engineering.

The Philadelphia-based Franklin Institute -- founded in honor of America's first scientist, Benjamin Franklin -- this past November cited Nayfeh "for the development of novel methods to model complex engineering systems in structural dynamics, acoustics, fluid mechanics, and electromechanical systems."

Competition for the Benjamin Franklin Medals is international. Participants from seven fields of science are eligible: chemistry, computer and cognitive science, earth and environmental science, electrical engineering, life science, mechanical engineering, and physics. In the past, Albert Einstein, Thomas Edison, Orville Wright, Marie and Pierre Curie, and Jane Goodall have been among the recipients.

Nayfeh has directed more than $25 million in engineering research, advised some 70 doctoral candidates to completion, and presented more than 600 technical papers. He authored a dozen books,

Nayfeh

and founded two prestigious journals: *Nonlinear Dynamics* and the *Journal of Vibration and Control*.

In 2008, Nayfeh received the Academy of Transdisciplinary Learning and Advanced Studies' Academy Gold Medal of Honor and the American Society of Mechanical Engineers' Tom Caughey Award, for which he was the first recipient. Additional awards include a lifetime achievement award from the American Society of Mechanical Engineers Virginia's Life Achievement Award in Science, both in 2005.

He is a Fellow of five societies: American Academy of Mechanics, American Society of Mechanical Engineering, American institute of Aeronautics and Astronautics, American Physical Society, and the Academy of Trans-disciplinary Learning and Advanced Studies.

COLLEGE NOTES

Dean's Message

2014 brings the Signature Engineering Building and a new president

The coming year will be one of excitement and change. After several years of dreaming, planning, and construction, the new $100 million Signature Engineering Building will open this May as a new crown jewel of education for not only the College of Engineering, but the university as a whole.

It was in the fall of 2005, my first semester as dean, when **Paul Torgersen** made the case that the college was in need of a replacement for Randolph Hall. Flash forward several years and much fundraising, and construction began in fall 2011. Seeing the building come to reality driving along Prices Fork Road and then touring inside the building as it took form has been a pleasure.

The Signature Engineering Building will include needed classrooms, labs, and office space for several of our departments, but it will be much more than Hokie stone and mortar. It also will serve as a living laboratory, with an ongoing experiment headed by **Pablo Tarazaga** and **Mary Kasarda**, both of our Department of Mechanical Engineering and the Virginia Tech Smart Infrastructure Laboratory.

They are now in the process of outfitting the building with more than 140 high-tech accelerometer mounts and numerous sensors, making this structure the most instrumented public building for vibrations in the world. With the experiment, professors Tarazaga and Kasarda hope to break new research ground on smart infrastructure concerning sensor logistics and system design, occupancy monitoring for emergency response, structural health monitoring, building security, dynamic model validation, and vibration testing, among other topics.

The work by these researchers and their students is inspiring, and another example of our university's mission to Invent the Future.


Benson

A final note on the Signature Engineering Building must include our gratitude to our alumni. Indeed, many of our amazing graduates, several who serve on our College Advisory Board or Committee of 100, worked tirelessly to help raise the funds and promote the building to the legislature in Richmond.

In particular, **John Sparks** and **Art McKinney** deserve our thanks.

But we also have alumni working on the building itself, leading it from a lot to its current glory. **Todd Shelton**, a 1993 graduate of the civil and environmental engineering department, has served as project manager for Virginia Tech. And serving as project manager for Gilbane Co., the construction company overseeing the building, is **David Childress**, class of 2006, also in civil and environmental engineering.

These Hokies are helping us take the College of Engineering into the future. I could not be more proud.

There's much more to be excited about during the coming year. At the Virginia Tech Corporate Research Center, a $3.5 million building dedicated to propulsion research will open in 2014, and we are fast at work on plans to renovate Holden Hall and then undertake a complete renovation of Randolph Hall.

Our growth is not just in buildings.

Elsewhere, the college's engagement with the University of Virginia and Rolls-Royce continues to grow through the Commonwealth Center for Advanced Manufacturing (CCAM) and the Commonwealth Center for Aerospace Propulsion Systems (CCAPS). Virginia State University and Old Dominion University have since joined CCAM in Petersburg. Increased funding for these efforts has allowed us to award three new Rolls-Royce Commonwealth Professorships to **Srinath Ekkad** of mechanical engineering, **Eric Paterson** of aerospace and ocean engineering, and **Jaime Camelio** of industrial systems engineering.

On this same page, we detail how our nuclear engineering program, based inside the Department of Mechanical Engineering, is blossoming and already has garnered multiple research grants.

You also can read more about our growth in student enrollment, *U.S. News and World Report* rankings, and the great accomplishments of our students and faculty throughout these pages.

Included in that last mention is our official entry into the burgeoning field of unmanned aircraft research, following an FAA designation of Virginia Tech as a test site. This is not just a coup for research and science, but an economic win as well. Integrating unmanned aircraft systems into the national airspace could add more than $13.6 billion to the nation's economy by the end of the decade, reaching as high as $82 billion by 2025, according to the Association for Unmanned Vehicle Systems International. Our thanks to **Jon Greene**, interim director of the Mid-Atlantic Aviation Partnership and an associate director of Virginia Tech's Institute for Critical Technology and Applied Science, for leading the effort to bring this test site status to Virginia Tech.

For several years, we have made strong strides in this field already with amazing work done by **Kevin Kochersberger**, **Craig Woolsey**, and more. The FAA designation is a grand acknowledgement of our groundbreaking research.

In closing, I must acknowledge the changes coming at Burruss Hall as we bid farewell to **Charles Steger** as he retires after serving 14 years as president of the university, and 49 years after entering Virginia Tech as a freshman.

All of us at Virginia Tech embrace a life of service as a core value, but no one has been a greater embodiment of the *Ut Prosim* spirit than President Steger. The university has been transformed since 2000 and has tremendous momentum thanks to Dr. Steger. His legacy will only continue to grow.

In June, President **Timothy Sands** will officially join us from Purdue University, where he currently serves as provost. He is a highly accomplished engineering researcher, educator, and academic administrator. He will have faculty appointments in the Department of Materials Science and Engineering and the Department of Electrical and Computer Engineering.

I am glad to not only welcome President Sands to the Virginia Tech family, but the College of Engineering family as well.

Richard C. Benson

Richard C. Benson, Dean, College of Engineering

College launches masters, doctoral programs in nuclear engineering

The nuclear engineering program at Virginia Tech received in July 2013 approval from the State Council of Higher Education for Virginia to award masters and doctoral degrees. The program is now underway, directed by **Alireza Haghighat**, professor of mechanical engineering.

Virginia has a very strong presence in nuclear power generation. The College of Engineering maintains strategic relationships with a number of nuclear-related industrial entities in Virginia, including AREVA NP Inc., Newport News Shipbuilding, Babcock and Wilcox, and Dominion Resources. The college also has long established ties with Oak Ridge National Laboratory and the Department of Energy.

The college revived its nuclear program in 2007 and soon started offering graduate coursework that allowed a student to earn a master's of engineering degree in mechanical engineering with a nuclear certificate. Leading the effort in mechanical engineering are two faculty members, **Mark Pierson** and **Eugene Brown**.

Related, Pierson is one of several investigators on two awards from the Department of Energy's Nuclear Energy University Program. One is an $800,000 award to develop an outer shield material for use in packaging spent nuclear fuel and high-level waste for prolonged storage, with **Leigh Winfrey**, assistant professor of mechanical engineering, as lead researcher. The second, valued at $300,000, allows the college to purchase a neutron generator system to create a Neutron Irradiation Laboratory.

U.S. News hails undergraduate, graduate programs as among best

Virginia Tech as a whole moved into the Top 25 public universities as ranked by *U.S. News and World Report* in its fall 2013 survey of undergraduate programs – "America's Best Colleges 2014." The College of Engineering ranked 15th overall and sixth among public universities in the United States.

In Top 10 department rankings: Engineering Science and Mechanics and the Grado Department of Industrial and Systems Engineering (ISE) each were listed at No. 8; the Charles E. Via Jr. Department of Civil and Environmental Engineering – in separate lists – ranked at 10th for civil and 11th for environmental.

In rankings for Best Graduate Schools 2015, released this past March, the college ranked 21st overall among the nation's best engineering schools, and 10th in the nation for public schools. In Top 10 departmental rankings, ISE was ranked at No. 8, while civil engineering ranked 10th and environmental engineering ranked eighth. The biological systems engineering department, shared with the College of Agriculture and Life Sciences, ranked eighth among biological/agricultural programs.

Previously in January 2014, *U.S. News* ranked the university's online Master of Information Technology degree program as No. 2 among the nation's best distance-learning courses in its third-annual Top Online Education rankings. The program – offered through a joint venture with the Pamplin College of Business – moved up from its third place spot from 2013. The program encompasses the Department of Computer Science and the Bradley Department of Electrical and Computer Engineering.

The college as a whole ranked 7th overall for Best Online Graduate Engineering Programs. It is the only engineering distance-learning program ranked in the Top 10 from the Commonwealth of Virginia.

engineering news

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ALUMNI NOTES

Computer science alum's Doritos commercial makes Super Bowl appearance

Virginia Tech Department of Computer Science alumnus **Raj Suri** (B.S., 1997) had a spectacular Super Bowl Sunday. No, he did not bet on the Seahawks decimating the Broncos. He couldn't have cared less about the game. The part-time actor/producer made a Doritos commercial that aired during the game, America's most-watched annual TV event. He won $1 million for his efforts, too.

The commercial – titled "Time Machine" – featured a precocious boy using a cardboard time machine and a few sleight-of-hand tricks to dupe an adult passerby out of his bag of Doritos. The spot – shot during one day and costing roughly $300, with much labor donated by friends and family – was one of five fan-made ads featured in the snack brand's annual contest to produce a Super Bowl advertisement.

Fans of the snack chip voted online, picking the commercial that would air. (Suri's ad can be watched at www.doritostimemachine.com/.)

Based in Phoenix, Ariz., Suri landed a job as a systems analyst at Intel right out of college in 1997.

On the side, in what Suri describes as a hobby, he works as a professional actor – he has a bit part in the 2009 James Caan drama "The Middle Men" – and also has been a producer for the past three years, the latter mostly local commercials.

The day after the Super Bowl, Suri and his team behind the commercial appeared on ABC's "Good Morning, America" and learned they won the $1 million grand prize from Doritos, as voted on by online users.

"I cannot wrap my mind around the fact that our commercial was seen by 111 million people," said Suri. "I cannot understand how that happens for $300. It shouldn't happen but it did. I'm extremely proud."

Photos courtesy of Raj Suri.

College inducts new academy members, honors outstanding young alumnus

Virginia Tech's College of Engineering in March 2013 inducted seven new members into its Academy of Engineering Excellence, an elite group that now consists of only 119 people out of its more than 60,000 living alumni.

"These alumni all represent people who have lived their lives representing the spirit of *Ut Prosim*," said **Richard C. Benson**, dean of the college and the holder of the Paul and Dorothea Torgersen Chair of Engineering.

The alumni are:

Major General Dan Dick, industrial and systems engineering, 1970: Served U.S. Air Force with a storied career that saw him rise to air combat command director of plans and programs, overseeing $18 billion annual budget, and then commander of the branch's largest composite wing, comprised of 8,000 personnel in five Arabian countries.

Regina Dugan, mechanical engineering, 1984, 1985: Served as the first female director of Defense Advanced Research Project Agency (DARPA) starting in 2009. In 2012, she left to form Motorola Mobility's Advanced Technology and Projects group after the company was purchased by Google.

Anne Ellis, civil and environmental engineering, 1980: Ellis is vice president for AECOM, a global provider of professional technical and management support services, and serves as president of the American Concrete Institute, the first female professional engineer to hold the position.

David Finkleman, aerospace and ocean engineering, 1963: Served as Cheyenne Mountain's chief technical officer and director of analysis for NORAD, and U.S. Space Command, as well as the U.S. Northern Command following Sept. 11, 2001. Only civilian appointed to USSPACECOM's Battle Staff.

Doug Juanarena, electrical and computer engineering, 1975: Developed electronic pressure scanner for NASA, spun invention off to form Pressure Systems Inc., with contracts at Boeing, McDonnell Douglas, and Airbus. Owns GenTek Ventures LLC and serves as vice-president of Rackspace Hosting Inc.

Peter Kurzhals, aerospace and ocean engineering, 1960, 1962, and 1966: Developed double-gimbaled Control Moment Gyro system for NASA. Served as NASA's Space Division director, then assistant director of mission operations at Goddard Space Flight Center. Later worked for Booz Allen, then McDonnell Douglas, and Boeing.

Michael Quillen, civil and environmental engineering, 1970 and 1971: Founded Alpha Natural Resources in 2002, after 28 years in mining industry. Serves as rector of Virginia Tech's Board of Visitors. Named 2011 Virginia Business Person of the Year.

The 2013 Outstanding Young Alumni Achievement Awards were:

Richard Bishop, mining and minerals engineering, 2002: Serves as vice president of investments for Aberdeen International, providing portfolio analysis and creating investment ideas for approximately $100 million resource investment portfolio.

Sastry Kompella, electrical and computer engineering, 2006: Has developed new approaches for pushing performance limits of complex wireless network systems for Naval Research Laboratory, focusing research on cognitive radios, layerless networking, high-tech networking, and sensor design.

Left to right: Anne Ellis, Dan Dick, Richard Bishop, Doug Juanarena, Regina Dugan, Peter Kurzhals, Sastry Kompella, David Finkleman, Mike Quillen, and Richard C. Benson, dean of the College of Engineering.

Beamon and Miller honored for service dedication, philanthropy

The College of Engineering in 2013 honored two alumnae for their longtime dedication and service to Virginia Tech: **Courtney Beamon**, who earned a bachelor's degree in 1995 and master's degree in 1996, both in civil engineering, and **Mary Miller**, who earned a computer science master's degree in 1985.

The recipient of the 2013 Distinguished Service Award, Beamon, of Midlothian, Va., is the president of Delta Airport Consultants, a privately-held specialty firm that practices exclusively in the aviation industry and provides a wide range of services to airport clients.

She joined Delta in 1996, starting as a project designer and project planner. She was continually promoted. After earning an MBA in 2007 from Virginia Commonwealth University, Beamon was named the company's chief financial officer. In 2012 she became president.

Beamon

At Virginia Tech, she has served on the advisory boards of both the Charles E. Via Department of Civil and Environmental Engineering and the College of Engineering Advisory Boards. On the college board, she served as chairwoman during 2012-13.

The 2013 Distinguished Alumna for the college, Miller is founder and president of the Blacksburg-based tech company Interactive Design and Development (IDD).

Miller

Serving several governors of Virginia, she has assisted in the commonwealth's efforts to implement the use of technology across the state. A founder of Virginia's Information Technology Investment Board, she has chaired its evaluation and governance committee.

Miller started at Virginia Tech as a student in 1968, earning a bachelor's degree in elementary education. She returned to the university in the early 1980s, earning a master's degree in computer science.

Originally funded with the university, Miller took IDD private in 1991. She has since spurred it into a major local success story, with clients as diverse as the American Federation of Teachers and Fortune 500 companies such as Hewlett-Packard.

During her launch of IDD as a company, Miller earned a doctoral degree in curriculum and instruction, finishing in 1996. The same year, IDD was named among the Top 100 U.S. Multimedia Developers and Miller was named Outstanding Woman Alumna by Women at Virginia Tech. Miller has since served on both the College of Engineering's and the Department of Computer Science's respective advisory boards, and the Committee of 100 and was named to the college's exclusive Academy of Engineering Excellence.

STUDENT NOTES

Aerospace team takes win in Mars mission competition

A team of aerospace students dominated the 2013 Revolutionary Aerospace Systems Concepts-Academic Linkage – or RASC-AL, for short – competition.

A team of aerospace engineering students took first place in the 2013 Revolutionary Aerospace Systems Concepts-Academic Linkage – or RASC-AL, for short –competition.

The team captured three first place slots, including the Human-Focused Mars Mission Systems and Technologies category; the undergraduate level competition; and the overall competition award. The team's theme this year was Project Rhea: A Manned Reusable Spacecraft for the Scientific Observation of Mars, and focused on a fuel-saving fusion rocket. Last year's team captured third place overall.

Sponsored by NASA and managed by the National Institute of Aerospace, the Cocoa Beach, Fla.-set design competition tasks university students with solving the myriad quandaries – environmental factors, choice of vehicle, fuel source and usage, and return trip home -- associated with a human-based mission to Mars.

Team members include **Divyanshu Agarwal** of Norfolk, Va.; **Dan Corio** of Mt. Airy, Md.; **Ben Massey** of Spotsylvania, Va.; **Jacob McGee** of Parrott, Va.; Juan Ojeda of Ashburn, Va.; **Isaac Root** of Fredericksburg, Va.; and **Evan Schrantz** of Radford, Va. All members graduated in May, before the competition, with bachelor's degrees in aerospace engineering.

The competition effort is part of two 4000-level engineering courses with the aerospace department, taught by **Kevin Shinpaugh**, director of information technology and computing services for the Virginia Bioinformatics Institute, and an adjunct professor in the aerospace department. He said each year's team in the competition starts from scratch. "I want them to see the whole design process."

"We drew on current plans and designs from other sources to accurately work these environments into our overall architecture," said McGee, student team leader. "We spent a semester and a half on it, and many of the things that went into our architecture, such as health and radiation concerns, are not something we cover in class. We really had to expand our knowledge on our own time, and hold ourselves accountable for the quality of our work."

Teams submit a written report, prepare a poster, and give an oral presentation, and also must formulate an education outreach program for younger students in primary and secondary schools, including real-world impact of the mission on common-day life. The team has regularly presented its theme to the Virginia Tech hosted Kids' Tech University as part of this component.

The team also took its project to the American Institute of Aeronautics and Astronautics Space 2013 Conference.

Virginia Tech competes in Robotics Challenge

In December two College of Engineering-based teams took part in the physical trials of the Defense Advanced Research Projects Agency (DARPA)'s Robotics Challenge. The competition's end goal: create rescue robots that can maneuver in disaster scenes and save lives. Competing against 16 teams – including professional robotics builders and NASA – were Team THOR, comprised of robotics students from mechanical engineering, and Team ViGIR, a collaboration between college spin-off company TORC Robotics and the Department of Computer Science.

Set tasks for the robots included: Driving a jeep through an obstacle course, traversing ruble, handling power tools, opening and walking through doors, and climbing a ladder. Both teams finished outside of DARPA's set Top 8 finalists, but recently learned they will continue with the competition in 2014 for a $2 million prize.

The Boston Dynamics-built robot FLOR -- short for Florian, patron saint of firefighters – removes debris from his path. The robot was operated by a combined team of College of Engineering spin-off company TORC Robotics and the Department of Computer Science.

Virginia Tech robotics students show THOR -- short for Tactical Hazardous Operations Robot -- to spectators at the DARPA event's expo area. Hundreds of visitors stopped by the tent to "meet" THOR, CHARLI the Humanoid Robot, and the soccer-playing DARwIn-OP robots.

STUDENT HIGHLIGHTS

James Cook competed in October's 26-mile Baltimore Running Festival, raising money for the Kennedy Krieger Institute for Spinal Cord Injury in Baltimore. Cook of Salisbury, Md., and a senior in mechanical engineering and a former Virginia Tech Naval cadet, was paralyzed in a 2011 car accident. The race was Cook's first marathon since the accident, although he is an avid athlete in basketball and lacrosse. Running with Cook in the race was Lindsay Bouchard, a student majoring in human development.

Department of Materials Science and Engineering alum **Daniel Flagg** of Seaford, Del.; **Michelle Leslie** of Cleveland; and **Brendan Robert Ondra** of Sunderland, Mass., won the ASM International's 2013 Undergraduate Design Competition, based on a project completed as seniors. The trio worked under faculty advisors **Douglas Holmes** of engineering science and mechanics, and **Diane Folz**, also of materials and science engineering. The winning project stemmed from an ongoing experiment involving the creation of a thin polymer probe that when inserted into a biological tissue substitute such as gelatin can be maneuvered by an outside source such as heat, electric voltage or light. Flagg, Leslie, and Ondra are now doctoral track students at other universities.

Alisha Konst, Robin Roston, and Allison Brown.

With funding from the National Science Foundation and Virginia Tech's Research Experience for Undergraduates Program, **Alisha Konst** of Botetourt, Va., and **Robin Roston** of Newport News, Va., both of mechanical engineering, served as researchers during a 2013 summer mentorship program at Virginia Tech's Center for Tire Research. The students worked under **Saied Taheri**, director of the center. A third participant in the Virginia Tech program, **Allison Brown**, is an engineering student at Virginia Western Community College.

Laha

Li

Computer science doctoral candidates **Bireswar Laha** and **Min Li** received an IBM Fellowship, a competitive international program honoring exceptional doctoral students who have an interest in solving problems essential to innovation. Originally from Konnagar, West Bengal, India, Laha's dissertation research focuses on virtual reality systems. Li, originally from Shishi, Fujan Province, China, focuses her research virtualized cloud computing.

Two student teams from Virginia Tech's electrical and computer engineering program qualified among the 15 finalists in an international competition to develop strategies for clear communication in spite of interfering signals on a radio channel. Teams, respectively from the Hume Center and Wireless@VT, placed 9th and 11th, respectively, out of 90 competitors in the DARPA Spectrum Challenge qualification round. Additionally, a Virginia Tech Middle East and North Africa team qualified for one of 24 wildcard slots. Team VT-Hume included **Daniel DePoy, Joseph Gaeddert, Mitch Davis, Zach Leffke, Chris Jennette, Marc Lerch, Michael Fowler, Kris Dixon**, and **Matt Carrick**. Team VT CogRad included **Jeff Poston, Jason Snyder, Dhiraj Amuru, Daniel Jakubisin**, and **Vireshwar Kumar**. The wildcard team included **Mohamed Ibrahim, Mohammed Karmoose, Karim Habak, Karim Banawan, Ahmed Elbagoury, Yahya Ezzeldin**, and **Ahmed Saeed**.

STUDENT NOTES

Doctoral student on Discovery Channel, gives TEDx talk

Amy Elliott

Amy Elliott, of Fayetteville, Tenn., and a doctoral student in the Department of Mechanical Engineering, was one of 10 contestants on the new Discovery Channel reality television competition show "Big Brain Theory: Pure Genius," which focuses on using logic and design to crack different engineering-related challenges each week. She finished second on the show which aired in spring 2013.

In each episode, contestants were tasked with forming the best engineering concept to solve a technical issue, and then split into two teams to carry out the plan. The losing team had one of its members eliminated from play by a panel of judges. Elliott watched the finale at Bull & Bones, a local restaurant and bar, with friends. (She was contractually barred from divulging the finale until after it aired.)

"This show is definitely not like what you would see on regular television," said Elliott before the show aired in April, being careful not to give away any hints of her fate as a contestant. "The challenges are really tough, it was just unbelievable what they thought we could accomplish. So in that respect, it will be interesting for the audience to get involved and try to follow along with our problem solving processes."

A "Big Brain" promotional release stated the show is "looking for the next great technological mind that could change the future," and supports learning through science, technology, engineering and math, or STEM for short. Challenges that Elliott and her cast mates faced varied: In the debut episode, contestants had to stop a pair of unmanned pickups before they collided in a head-on impact, and the finale centered on the teams – one led by Elliott -- building a makeshift bridge for a pickup truck to cross a wide gap.

At the time of the show's airing, Elliott was in her in her fourth year of study for a doctorate and a member of the Virginia Tech DREAMS – short for Design, Research, and Education for Additive Manufacturing Systems – Laboratory.

Elliott finished 2013 in another spotlight, closer to campus: She was one of 16 speakers at the second annual TEDxVirginiaTech event. Her talk, titled "Re-fostering Innovation in America," focused on lessons in engineering and education she learned from participating in "Big Brain Theory." As of press time, Elliott was working at Oak Ridge National Labs doing research on Additive Manufacturing, or 3-D printing, and successfully defended her dissertation with an eye toward a June 2014 graduation.

Doctoral student wins IEEE award for work on construction helmet sensors

Computer engineering doctoral student **Jason Forsyth**'s research into the installation of wearable computing sensors on helmets of construction workers to detect carbon monoxide may save lives. It also won him Best Paper from the Institute of Electrical and Electronic Engineers (IEEE)'s Conference on Automation Science and Engineering.

The paper was written by Forsyth, of Durham, N.C., as part of his master's thesis, and his adviser, **Thomas Martin** of electrical and computer engineering, **Deborah Young-Corbett**, an assistant professor of civil and environmental engineering, and Ed Dorsa, associate professor of industrial design.

In the paper, the team said they placed a special sensor onto a typical construction helmet to allow continuous and noninvasive monitoring of workers' blood gas saturation levels. The results of their study showed that a user of this helmet would be warned of impending carbon monoxide poisoning with a probability of greater than 99 percent. During the test, student subjects mimicked construction work.

College of Engineering doctoral candidate Jason Forsyth won a Best Paper award for his work in creating carbon-monoxide sensors for helmets of construction workers.

Carbon monoxide poisoning is a significant problem for construction workers in both residential and industrial settings. The danger exists because the exhaust from gasoline-powered hand tools can quickly build up in enclosed spaces and easily overcome the tool's users and nearby co-workers.

To show the feasibility of monitoring for carbon monoxide without subjecting users to dangerous conditions, the team used a prototype for monitoring the blood oxygen saturation. The difference for monitoring for oxygen and for carbon monoxide differs only in the number of wavelengths of light employed, so if monitoring proved feasible, then the monitoring for carbon monoxide would be feasible as well. A helmet was selected to hold the sensor as it is worn year-round by construction workers.

"Work on a sensor for helmets is only the beginning in preventing worker injuries," said Forsyth.

"This helmet is only a first step toward our long-term vision of having a network of wearable and environmental sensors and intelligent personal protective gear on construction sites that will improve safety for workers," according to Forsyth's paper. "While this helmet targets carbon monoxide poisoning, we believe there are compelling opportunities for wearable computing in reducing injuries due to falls, electrocution, and particulate inhalation, as well as workers on foot being struck by vehicles."

Sophomores capture first place in aerial robotics competition

In April 2013, a team of College of Engineering students won first place at the Collegiate Aerial Robotics Exhibition held in Milwaukee, Wis., dominating a sporting-like competition where unmanned model-sized quad copters and ground-based robots collected and launched tennis balls at set targets.

Virginia Tech's Collegiate Aerial Robotics Demonstration (CARD) team fielded both a ground robot and an aerial robot, with each match requiring the robots to pick tennis balls off the ground and then fire them into five towers of varying height with holes cut into the sides and tops. The ground robot fired balls into the side openings, and the aerial robot scored by dropping balls into the towers from above.

"When they read off the final score, it felt like everything had come full circle, like all the 20-hour days and all the scrambling and scraping had been worth it," said **Josh Eddy** of Arlington, team leader and a sophomore in aerospace engineering at the time of competition. "It felt like we had proven everything we set out to prove."

The team won six of their nine matches with the robots, both designed and self-built by the students.

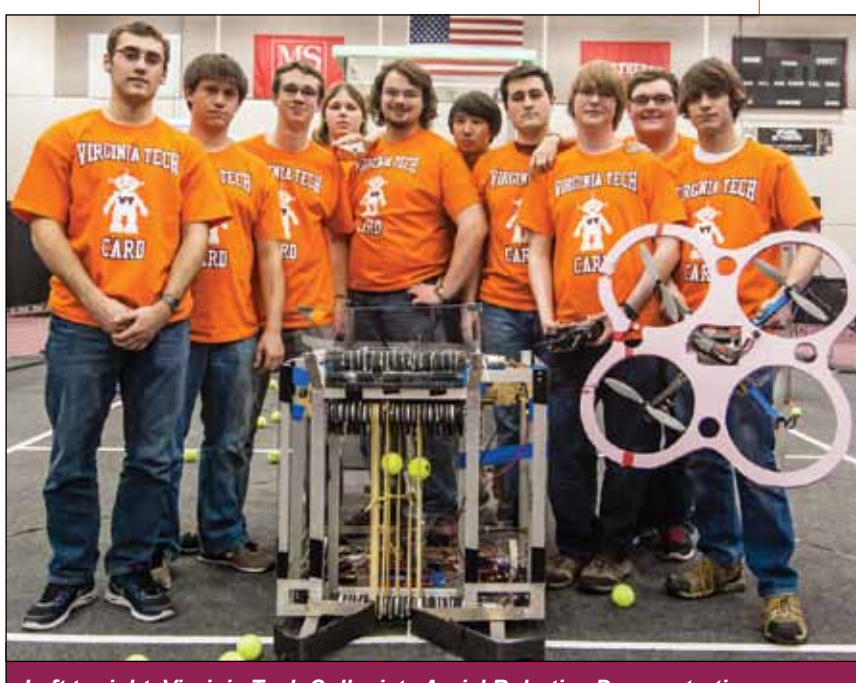
The 14-member Hokie team is comprised of sophomore engineers, several of whom earlier competed in the FIRST Robotics Competition, an international high-school design challenge. The Collegiate Aerial Robotics competition was launched in 2010, and this year hosted by Milwaukee School of Engineering.

Virginia Tech was the only team in competition to design robots that could successfully reload tennis balls during the match, said Eddy. The team also was the first to break 100 points in a match, going on to repeat that performance during three more matches and setting the high score for the day, he added.

The CARD team formed in fall 2012, but with no intention of competing until 2014, after a year focused on prototyping and research. By January 2013, however, after a series of test runs, the team decided to enter the competition. **Kevin Kochersberger**, director of the Unmanned Systems Laboratory at Virginia Tech, served as the team's faculty adviser.

"Virginia Tech's quadcopter was the only robot that could reload itself midgame, and was capable of picking up three tennis balls at a time," said Eddy. "Scoring required expert maneuvering with limited depth perception, so a system of hand signals was developed so that students on the sidelines could direct scoring efforts."

Additional team members, all sophomores, included: **Tyler Clark, Brad Edelin, Wesley Edge, Billy Greer, Kevin Hetzer, Wes Holland, Jared Klein,** and **Tim Kurtiak, Brian Wright, Bryan Yanchulis**.



Left to right, Virginia Tech Collegiate Aerial Robotics Demonstration team members are Kevin Hetzer, Brad Edelin, Josh Eddy, Bryan Yanchulis, Tyler Clark, Brian Wright, Wesley Edge, Billy Greer, Wes Holland, and Tim Kurtiak. All were sophomores at the time of competition. (Photo courtesy Collegiate Aerial Robotics Exhibition.)

FACULTY ACHIEVEMENTS

College names Cox and Lester as department heads

The Department of Chemical Engineering and the Bradley Department of Electrical and Computer Engineering each welcomed new department heads during the past year.

David Cox now heads chemical engineering. Cox served as interim head for the 2012-13 academic year, replacing **John Walz**, who left for a position with the University of Kentucky.

Cox's research focuses on heterogeneous catalysis and surface chemistry, with specialties in experimental ultrahigh vacuum surface science and computational chemistry. He is the principal investigator on a $465,000 grant from the Department of Energy's Office of Basic Energy Sciences, and a member of the American Vacuum Society, American Chemical Society, American Institute of Chemical Engineers, North American Catalysis Society and the Southeastern Catalysis Society.


Cox

Luke Lester took the reins of the Bradley Department of Electrical and Computer Engineering in August 2013, taking over from **Scott Midkiff**, who in 2012 was appointed as Virginia Tech's Vice President for Information Technology and Chief Information Officer. **Paul Plassmann**, professor of electrical and computer engineering, served as the interim department head.


Lester

Previously at the University of New Mexico, Lester is known for co-founding of Zia Laser Inc. Serving as its chief technology officer from 2001 until 2003, and its chief research officer from 2003 until 2005, he raised $11 million for the first quantum dot laser company that developed products for communications and computer/microprocessor applications. He also is well known for co-inventing the first pseudomorphic high speed, high-electron-mobility transistor, a device later highlighted in the Guinness Book of World Records as the fastest transistor.

In the Department of Engineering and Science Mechanics, **Ishwar Puri** left for a position at McMaster University in Canada. **Scott Case** is serving as interim head.

Pruden leads study of antibiotic resistance following Colorado flood

Amy Pruden, professor of civil and environmental engineering, is using a National Science Foundation RAPID grant to study the effect on antibiotic resistance genes caused by the fall 2013 flooding in Colorado.

Pruden has been monitoring the watershed of the South Platte River Basin, southwest of Denver, Colo., for more than 10 years. The project's new goal, post flood, is to better understand the role watershed processes play in disseminating resistance.

The September 2013 flooding in Colorado hit hard 17 counties over a spread of 200 miles north to south, transporting enormous loads of sediment and transforming the semi-arid landscape of the Front Range of Colorado.

In agricultural areas, excreted antibiotics can then enter stream and river environments through discharges from animal feeding operations and the like. That water then is filtered through wastewater treatment plants and may also contain used antibiotics. Consequently, these releases become "potential sources of antibiotic resistance genes," said Pruden.

Pruden and her team now want to clarify what mechanisms control the fate and transport of antibiotic resistance genes originating from wastewater treatment plants and animal feeding operations in the watershed. Previous data collected on the watershed will help greatly.

The team's method will be to compare the antibiotic resistance elements in water and sediment samples along a defined pristine-urban-agricultural river gradient from before and after the flood.

Pruden said reducing the spread of antibiotic resistance is a critical measure needed to prolong the effectiveness of currently available antibiotics. This is important since "new drug discovery can no longer keep pace with emerging antibiotic-resistant infections," said Pruden, who has been credited with pioneering the concept of antibiotic resistance genes as environmental pollutants.


Emily Lipscomb, of Swanton, Md., a National Science Foundation graduate research fellow, is working on this project along with assistance from undergraduate students. Lipscomb is pictured collecting samples in the watershed of the South Platte River Basin, near Denver, Colo.

Emily Lipscomb, of Swanton, Md., an NSF graduate research fellow, will help carry out the project along with assistance from undergraduate students alongside the trio of faculty leading this work.

In a separate project, also funded by National Science Foundation RAPID grant, **Andrea Dietrich**, also a professor of civil and environmental engineering, will study the physical and chemical behavior in the environment of a dangerous chemical spilled into a West Virginia river in early 2014.

De Vita receives Presidential Early Career Award


De Vita

Raffaella De Vita, associate professor of engineering science and mechanics, was named a recipient of the Presidential Early Career Award for Scientists and Engineers (PECASE), the highest honor bestowed by the U.S. government on science and engineering professionals in the early stages of their independent research careers.

The honor follows her 2012 National Science Foundation Faculty Early Development (CAREER) Award to lead a study on pelvic floor disorders, affecting some one-third of adult American women.

Pelvic floor disorders include urinary and/or fecal incontinence, and pelvic organ prolapse that occurs when the pelvic organs protrude into, or out of, the vaginal canal. Costs related to pelvic organ prolapse surgeries total more than $1 billion annually, not counting costs associated with lost productivity or decreased quality of life. Not much is known about the disorder including prolapse because these disorders are not publicly talked about openly as, say, breast cancer.

De Vita's research strategy is to determine the elastic and viscoelastic properties of two major ligaments supporting the uterus and the vagina: the uterosacral and the cardinal ligaments. She and her research collaborators are characterizing the roles these ligaments play as supportive structures of the uterus and the vagina.

"This project could potentially transform surgical reconstruction methods and post-operative rehabilitation procedures for females suffering from pelvic floor disorders," said De Vita.

Cao, Simmons win CAREER grants

Virginia Tech assistant professors **Guohua Cao** and **Denise Simmons** each won five-year, $400,000 National Science Foundation CAREER grants during the past year. The CAREER grant is considered the NSF's most prestigious award, given to creative junior faculty likely considered to become academic leaders of the future.

Cao of the Virginia Tech – Wake Forest School of Biomedical Engineering, will use his grant to further develop a new, five-dimensional detailed, noninvasive micro-computer x-ray scans of atherosclerotic plaques, dangerous blockages in blood vessels that can lead to heart attacks or strokes. Cao is currently studying the method using mice.

Cao plans a carbon-nanotube field emission X-ray source to reduce the blurring of pictures that comes from the heart motions and to achieve the required time-based high resolution.

Simmons, an assistant professor in the Myers-Lawson School of Construction and the Charles E. Via Department of Civil and Environmental Engineering, will use her CAREER Award to study methods to boost the number of engineers entering the work force.

Work from this award builds off that from her time as a post-doctoral associate in Virginia Tech's Department of Engineering Education. There, she worked on a NSF Collaborative Proposal titled, "Developing Engineer of 2020 Traits: How do Non-curricular Activities Impact African American Students."

She seeks to boost new career engineers by "shaping practices and policies in retention, informal learning, pedagogy, professional competency, workforce development, and life-long learning." She further wants to become a leader in research that broadens the participation of students completing engineering degrees, focusing on racial minorities and women.

Her research will include collecting data from five universities with strong showings of female and minority students: Georgia Tech, North Carolina State University, Tennessee State University, the University of Texas-Pan American, and Virginia Tech.


Cao


Simmons

FACULTY ACHIEVEMENTS

Jung studies the physics of clapping wet hands


Jung

Ever clap your hands while they are wet? As we once were all children, we'll take that as an affirmative. **Sunny Jung** of engineering science and mechanics took that action and studied it, turning it into a research project that garnered publication in the journal *Physical Review E*.

In the paper, Jung and five colleagues reported on the dynamics of squeezing fluids using a simple experiment of clapping with wet hands. Jung described the outburst of fluid motion as a unusual physical phenomena. The research potentially may impact drug delivery methods and fuel efficiency standards.

During the research, Jung and his team found that when liquid is compressed suddenly between two objects, a film of liquid is ejected radically and generates fluid treads and droplets at a high speed.

"Everyone has experienced water drops hitting one's face when wet hands are clapped," Jung said, adding that the scientific question rests on why a thin film of liquid, in this case, water on the hands, break into small drops by the squeezing or clapping motion. "To transit from a film to drops, fluids need to undergo instability, and in this case, it is the up and down crown splash due to surface tension."

Jung and his team found that other comparable fluids such as gasoline and oil behave similarly, but a viscous fluid such as honey would not. Oil companies are interested in this research because of the oil separation process. In this process, "such interfacial dynamics of multiphase fluids serve as one of the fundamental mechanisms," Jung said.

Jung received funding for this work from the American Chemistry Society – Petroleum Research Fund and the National Science Foundation. His team included **Sean Gart** of Salem, Va., **Brian Chang** of Burke, Va., and **Randy Goodnight** of Falls Church, Va., all students in engineering science and mechanics, as well as researchers from France and Korea.

Jung previously made headlines with a study on how cats use fluid inertia to defeat gravity while drinking liquid.

FACULTY HIGHLIGHTS


Agah


Pruden

Electrical and Computer Engineering's **Masoud Agah** and Civil and Environmental Engineering's **Amy Pruden** developed a portable 3D-printed microfabrication device that can detect pathogens in water. Their work was featured in the Institute of Electrical and Electronic Engineers' *Journal of Microelectomechanical Systems*.

Lissett Bickford of the Virginia Tech-Wake Forest School of Biomedical Engineering developed a flexible microneedle patch that allows drugs to be delivered directly through the skin. The patch was developed when Bickford was a post-doctoral researcher at University of North Carolina Chapel Hill.

Rafael Davalos of biomedical engineering is leading a research team that developed an electric-pulse-based cancer treatment for horses. The technology, developed with researchers from the Virginia Tech-Wake Forest University School of Biomedical Engineering and Science, may have use in treating people.

Engineering Science and Mechanics' **David Dillard**, the Virginia Tech Adhesive and Sealant Science Professor, received the Society for Adhesion and Adhesives' 2013 Wake Memorial Medal.

Stefan Duma led several national studies related to reducing football player concussions, including presenting new data that shows reducing contact between youth football players during practice can reduce injuries overall, and new information that shows ranking of brand helmets against each other is cutting the number of head injuries to players. As of press time, Duma was to release data that ranks hockey helmets, also for the reduction of concussion incidents.

Electrical and Computer Engineering's **Greg Earle** is leading a $900,000 National Science Foundation effort to build a satellite to observe weather-system created waves in very high altitudes -- 300,000 feet and above – that are believed to disrupt radio waves and global positioning system (GPS) signals.

Sam Easterling, head of the Charles E. Via Department of Civil and Environmental Engineering, was appointed to the Virginia Tech Academy of Faculty Service.

Marc Edwards, the Charles P. Lunsford Professor of Civil and Environmental Engineering, published research in the journal *Environmental Science and Technology* that shows fetal death rates increased in Washington, D.C., during two separate lead-in-water contamination events in 2000-2003 and 2007-2009.

Srinath Ekkad and **Uri Vandsburger** received a $500,000 grant from the U.S. Department of Energy as part of a multi-university effort to conduct advanced gas turbine technology research. Solar Turbines, a manufacturer of gas turbine engines, is providing match funds of $125,000.

Electrical and Computer Engineering's **Steve Ellingson** led the demonstration of a new antenna feed system for the National Radio Astronomy Observatory's Very Large Array astronomical observatory in New Mexico. The new system was designed by Virginia Tech alumnus **Mahmud Harun**.

The State Council of Higher Education for Virginia named **Wu Feng** of computer science as a 2014 Outstanding Faculty Award winner, the commonwealth's highest honor for university faculty.


Klauer

A study by **Charlie Klauer** of the Virginia Tech Transportation Institute appeared in the *New England Journal of Medicine*, focusing on teen drivers and the dangers of multi-tasking at high frequency rates – dialing cell phones, eating, etc. – and thus greatly raise the risk of crashes and/or near-crash incidents.

Fred Lee, director of the Center for Power Electronics Systems, is leading the university's efforts as part of a $140 million multi-university/partner Clean Energy Manufacturing Innovation Institute announced by President Obama.

Chang Lu of chemical engineering and the School of Biomedical Engineering and Sciences is leading a $710,000 National Institutes of Health effort in studying protein-DNA interactions, work Lu said could "revolutionize the study of molecular mechanisms involved in cancer development in multiple aspects."

Institute for Critical Technology and Applied Science Director **Roop Mahajan** received the American Society of Mechanical Engineers Heat Transfer Division's 75th Anniversary Medal at its 2013 Summer Heat Transfer Conference.

Linsey Marr of civil and environmental engineering received a $2.28 million U.S. National Institutes of Health New Innovator Award to support research of influenza transmission via bio-aerosols. Collaborators include **Peter Vikesland**, also of civil and environmental engineering.


Marr

T.M. Murali, associate professor of computer science, received the title of Association for Computing Machinery's Distinguished Scientist, honoring his significant impact on the computing field.

Doug Nelson received the National Science Foundation's 2013 Outstanding Long-Term Faculty Advisor Award for his work with EcoCar2 competition and the Hybrid Electric Vehicle Team. Nelson received the award three times previously, most recently in 2009.

Christopher North and **Naren Ramakrishnan**, both of computer science, were part of a team that won a Yelp-sponsored contest that allows users of the review app site better control of sorting opinions, good and bad, by using key words. Student team members included Ji Wang of Shanxi, China, and Sheng Guo, of Jiangsu, China.

Jung-Min "Jerry" Park of electrical and computer engineering is serving as Virginia Tech site director as part of a National Science Foundation-funded group set on expanding access to and security of broadband wireless networks. Virginia Tech will receive $300,000 during a five-year period. Park also is heading a $1.2 million NSF project to improve wireless spectrum sharing, collaborating with **Patrick Schaumont** of electrical and computer engineering.

Robert Parker, head of mechanical engineering, was elected to the American Society of Mechanical Engineers' Department Heads Executive Committee.

Shashank Priya of mechanical engineering helped lead a Proceedings of National Academy of the Sciences study that cracked how jellyfish move with minimal use of energy by using a critical pause between the contraction and expansion of their bell-shaped body to create a vortex. The findings will be used as researchers continue to design bio-inspired jellyfish for the U.S. Navy, as Priya has with several robotic jellyfish, one the size of a grown man.


Ryder

The American Association of University Women of Virginia named **Barbara Ryder** of computer science as its biennial Woman of Achievement Award winner. She was honored for her career's work, including her being a founding member of the National Center for Women and Information Technology Pacesetters program.

Mechanical Engineering's **Corina Sandu**, director of the Advanced Vehicle Dynamics Laboratory, received the Society of Automotive Engineers International's Forest R. McFarland Award.

Glenda Scales, associate dean of international programs and information, was appointed to the Southern Regional Education Board, a 16-state board dedicated to improving public education from preschool to postsecondary education.

Mahendra Singh, professor of engineering science and mechanics, received a Distinguished Alumnus Award from the Indian Institute of Technology at Roorkee, India. He previously received a two-year, extendable distinguished visiting professorship with the university's civil engineering department.

Snakes that fly – while falling from tree heights -- contort their bodies into an arched semi-circle airfoil that resembles the popular culture imagery of UFOs, according to research published in the *Journal of Experimental Biology* by **Jake Socha** of engineering science and mechanics.


Stiles

Ken Stiles, a lecturer with the Ted and Karyn Hume Center of the Bradley Department of Electrical and Computer Engineering and the College of Natural Resources, and a former career employee of the Central Intelligence Agency, was awarded the Career Commendation Medal from the agency.

Scott Verbridge of biomedical engineering helped establish a 3-D microfluidic system to study endothelial sprouting, a biological process seen as an early step in the growth of new blood vessels.

Chao Wang of electrical and computer engineering, received a $510,000 Office of Naval Research Young Investigator Program grant to develop tools that can detect security soft spots in software that runs on multi-core computers.

Erik Westman, associate professor of mining and minerals engineering, was appointed as the college's interim associate dean for academic affairs, following **Bevlee Watford**'s departure for a two-year stint as a program manager with National Science Foundation.

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NEWS ROUND-UP

Signature Engineering Building nears completion

The Signature Engineering Building, located near the corner of Prices Fork Road and Stanger Street, is set to open in May 2014, nine years after initial planning began on the $100 million, 150,000-square-foot structure. Construction on the building began in fall 2011.

It will feature eight classrooms, more than 40 laboratories and 150 offices, a 300-seat lecture hall and café, both on the first floor, and a third-floor communications center. It is expected to receive a gold-rating status from the LEED Green Building Rating System for New Construction and Major Renovations.

The building also will serve as an ongoing construction engineering experiment as well, headed by **Pablo Tarazaga** and **Mary Kasarda**, both of mechanical engineering and the Virginia Tech Smart Infrastructure Laboratory. Tarazaga and Kasarda will outfit the building with more than 140 high-tech accelerometer mounts and numerous sensors, making the SEB the most instrumented public building of its kind for vibrations in the world.

The lab, which features both undergraduate and graduate students, hopes to crack open new data on smart infrastructure concerning sensor logistics and system design, occupancy monitoring for emergency response, structural health monitoring, building security, and vibration testing, among other topics. Sensors, according to Tarazaga, will be able to detect not only occupants inside the building as they move about, but wind stresses on the structure, as well as expected typical settling of the structure. In the event of another earthquake, such as the one that struck Virginia in 2011, the sensors would be able to detect any resulting movement. Tarazaga said interest in the project is high, from the construction industry to military interests.

Another standout feature is the inclusion of a massive Rolls-Royce Trent 1000 engine that hangs in the main atrium. Rolls Royce plans to outfit an area round the lobby with interactive kiosks containing information on the design of the engine geared to not just current engineering students, but younger visitors.

Top left: The Signature Engineering Building in September 2013. Top right: Pablo Tarazaga (second from left) holds two sensors that will be installed inside the Signature Engineering Building as part of a project for his Smart Infrastructure Laboratory. Tarazaga, an assistant professor of mechanical engineering, serves as director of the lab with professor of mechanical engineering Mary Kasarda as associate director. Pictured with Tarazaga are mechanical engineering students Mico Wooland, Joseph Hamilton, and Bryan Joyce. Bottom right: The 300-seat Quillen Lecture Hall is on the first floor of the building.

Power Up

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Gifts of appreciated assets, such as securities and real estate you have owned for a year or more, typically bypass capital gains and ordinary income taxes. This reduces the effective cost of your gift when compared to a gift of cash.

Learn how you can support the College of Engineering with a powerful, tax-wise gift to help Virginia Tech's engineers continue to invent the future. Phone **Erin Edwards** at (540) 231-4066 or email eedwards@vt.edu, or visit www.givingto.vt.edu.

Drones *Continued from page 1*

award more than $2.6 million during a three-year period in Federal Action Contingency Trust (FACT) funds to Virginia Tech to operate an unmanned aircraft systems test site.

The funds will take the Mid-Atlantic Aviation Partnership from its current "volunteer" status to a fully functional and revenue-producing organization, capable of competitively analyzing and testing unmanned aircraft systems for industry and government.

In Virginia, the work and resulting economic impact will be distributed across the commonwealth, but focused in Blacksburg, Dahlgren, Wallops Island, and Blackstone and in regions such as Hampton Roads and Northern Virginia, with the largest concentration of aviation or related companies.

Virginia Tech already is well-regarded for making headway into unmanned aircraft research, including work carried out by **Kevin Kochersberger**, director of the Unmanned System Lab at Virginia Tech, among others. At Virginia Tech, small helicopters have been tested as likely tools to be used in search and rescue operations following a disaster. Small planes also have been used by university researchers in studying microbes in the upper atmosphere.

"With our partners, we firmly believe we can introduce this new technology the right way," said **Jon Greene**, interim director of the Mid-Atlantic Aviation Partnership and an associate director of Virginia Tech's Institute for Critical Technology and Applied Science. "Separately the team members have flown unmanned aircraft systems for thousands of hours, and now we have joined together to conduct unmanned aircraft systems research, development, and test and evaluation activities."

In addition to expertise, the mid-Atlantic region contains both uncongested and restricted airspace, land and water terrain, and access to sea-level and high altitudes. The region also has an extensive agricultural base, which is considered the primary growth area for unmanned aircraft systems technology.

Integrating Unmanned Aircraft Systems into the national airspace could add more than $13.6 billion to the nation's economy by the end of the decade, reaching as high as $82.1 billion by 2025, according to the Association for Unmanned Vehicle Systems International.