Message From the Dean

CEAS Vision
To be the national choice for engineering education and a world leader in knowledge creation

At CEAS we believe that undergraduate education is the cornerstone of a successful career. Beginning at the undergraduate level, we prepare our students for the technological challenges they will face over the term of an entire career. Our responsibility as an institution of higher learning is to produce engineers and technologists with the ability to work toward scientific and technological advancement in the most creative way possible. The collective efforts of CEAS center on one overarching direction — making the University of Cincinnati College of Engineering and Applied Science the premier undergraduate engineering and technology institution in the United States.

The mission of the College of Engineering and Applied Science is to provide:

- Excellence in Education — offer a world-class education to our students.
- Excellence in knowledge creation and transfer in support of education and community — impart the best education featuring new breakthroughs in science and technology and make available that knowledge of science and technology both to our students and to our local community.
- Accessibility — supply a venue where qualified students who want to come, can come; and provide the support necessary to allow them to be successful.

CEAS believes that research in universities should enhance the educational mission, not become the mission. Research universities provide a great education when they recognize that research has a primary purpose of enhancing the undergraduate educational experience. A secondary effect is that students who experience research first-hand absorb knowledge and are able to transfer it because they are skilled in implementing the newest and latest technologies. Perhaps even more important, a university opens up a whole universe of knowledge and culture, allowing students to explore new interests and enrich their lives. This process requires that education be delivered through a rich university experience, one that provides meaningful engagement with faculty and peers and provides direct access to cultural offerings and resources beyond the purely technical. In this way, broad-based education provides a foundation that supports a student, intellectually and then financially, from first job to retirement. A world-class engineering education and economic prosperity are indelibly linked.

The number of prospective students confirming admission for autumn 2011 is up over 20% compared to last year. The average ACT score of students offered admission to engineering continues to increase. Impressively, over 38% of students offered admission to engineering in autumn 2011 have an ACT score of 30 or above. That would put them in the top 5% of all 2010 high school graduates in the state of Ohio.

As CEAS begins construction on the Alumni Engineering Learning Center in autumn 2011, we will also be launching the first of our new initiatives aimed at further improving the educational experience for undergraduates — the Integrated Engineering Program. The Integrated Engineering Program will feature college-wide introductory courses focusing on proven pedagogies — student teamwork, active learning, and peer-level tutoring. These courses will help beginning engineers establish connections between engineering and information presented in mathematics and science classes, develop a deep understanding of calculus, and develop good problem solving techniques. These new courses will also provide students with college-level training in professional skills, including teamwork, problem solving and communications.

CEAS is re-claiming its reputation as the global leader in engineering education and innovation, a designation earned when Herman Schneider launched cooperative education at UC over 100 years ago. These initiatives have been developed and shaped with college alumni who have offered many comments and suggestions in my visits with them during the past five years. Their participation has significantly contributed to the College’s quality and its exciting future. Please contact me if you have additional ideas or comments.

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Recognized as one of the leading crisis management professionals and an expert in business turnarounds, Kenneth Glass followed his UC education (BS in Mechanical Engineering and MS in Aeronautical Engineering) with managerial and CEO positions with a number of manufacturing companies. As CEO of the Stony Point Group and of Glass & Associates, his extensive expertise in restructuring troubled companies continues to bolster American industry.

John Grisik is the inventor or co-inventor on ten U.S. patents and numerous international patents. He holds BS, MS and DS degrees from UC in materials engineering and a master’s in management from Stanford University. Grisik recently retired as Executive Vice President of Operational Excellence and Technology at Goodrich Corporation and serves as the immediate past chairman of the General Aviation Manufacturers Association.

A Cincinnati native and graduate of Withrow High School, Robert Wright has served in the Cincinnati Fire Department since 1973 rising to the rank of Chief. He received his BS in Fire and Safety Engineering Technology from UC and is a member of the International Association of Fire Chiefs and the National Fire Protection Association. Wright is assisting the college with its proposed MS in Homeland Security degree.

Other honored guests will include the 2011 winners of the Wandmacher Teaching Award and the College Research Award, the Mary McCormick Staff Award, and student winners of the Dean’s Award and the Herman Schneider Award. For more information visit: www.ceas.uc.edu/banquet.
Research continues to fuel the college’s recognition as a regional and international technology powerhouse as CEAS faculty drive solutions to challenges as diverse as the companies and students it serves. Excellence in any form, and particularly that led by research, becomes a force of its own and one with energy to carry students to ever higher levels of achievement and encourage faculty researchers to dig even deeper for innovative solutions.

CEAS routinely solves problems, consults on process issues, improves products, and creates new ones. While mostly commercialized by our industry partners, a number are being brought to market through start-up companies either owned or directed by CEAS faculty. Combining innovation and entrepreneurship fosters excellence as researchers strive for the next breakthrough and students realize the opportunities available to them.

As CEAS research grows, the college’s laboratory facilities expand with leading edge equipment and expanded capabilities benefitting students and researchers alike. As our research produces more breakthrough results, excellence is the only standard.

Due to its real-world research and economic impact, UC's aerospace engineering program was named an Ohio Center of Excellence. Since 2004 the Aerospace Engineering program has conducted more than $100,000,000 in research, overseen the start-up of seven companies and generated in excess of $600,000 of license income for itself and the research partners of the School of Aerospace Systems.

UC’s Center of Excellence in Aerospace Engineering builds on current strengths and develops innovative, breakthrough technologies to provide the next generation of aircraft power and propulsion systems, advanced composite materials and coatings, and intelligent systems technologies. These technologies affect every aspect of an air or spacecraft and are vital to its design and performance.

Advanced structural techniques yield seismic results. Strengthening bridges already standing, adding decking panels that are lighter and stronger, testing the strength of individual bridge components, and creating new systems to assist buildings withstand severe seismic loads are all in a day's work at CEAS. UC researchers are applying composite materials to bridges to strengthen critical joints and extend bridge life. The high strength, stiffness, light weight, and non-corrosive nature of composite materials make composite plates and components ideal for bridge decks and supplemental strengthening applications.

UC processes for marrying concrete and structural steel better leverage the strengths of both and the applications can be seen in buildings around the world. Incorporating “fuses” (a recent UC innovation) in key locations within the core structure will enable reestablishing quickly a building’s integrity following an earthquake.
Robots address everything from home care to vehicles. When thinking of robots, R2D2 and C3PO come to mind and while they are in our future, robotics is very much “alive” at CEAS. Faculty and student teams are addressing applications for home care where robots enable seniors to remain in their homes by handling patient monitoring, pill and food dispensing, and household chores. Research is currently underway on design and testing of a dynamic prototype of the inner ear which may lead to development of artificial ears.

Robots at UC are also moving information, interacting and working in teams, traveling obstacle courses, and flying through forest fires. A NASA sponsored Unmanned Aerial Vehicle (UAV) will be tested this summer flying through controlled forest fires in West Virginia to evaluate its performance and determine its effectiveness in identifying hot spots and how best to deploy resources to combat the fire.

Disposable e-Readers and brilliant colors lead next-gen displays. Vivid colors and paper backed displays are two results of advances from the CEAS nanoelectronics laboratory that are ready for commercialization. Using electrofluidic optics, combining liquids with light, UC researchers electrically enhance the color of pigments to levels matching the visual brilliance of printed materials. Consumers can expect to see e-readers and computers with brilliant color in any light conditions while business windows turn into signs upon command.

While glass rules the world of displays today, CEAS research is proving the viability of paper as a high performance display option. Using paper as the host material for electrowetting, where an electric field is applied to colored droplets in a display, yields an inexpensive, environmentally friendly and yet flexible medium for displays. Paper displays could be easily rolled, distributed, used and then thrown away.

Researchers Jason Heikenfeld (L) and Andrew Steckl, in the nanoelectronics lab

DNA going through nanomotor core in lipid membrane

Nanotechnology breakthroughs use RNA and nanopores. Engineering functional systems at a molecular scale is an everyday occurrence at CEAS as UC researchers explore the use of RNA as building blocks for assemblies in nanotechnology and nanomedicine applications. RNA is easily manipulated and has the structural versatility and catalytic function similar to proteins. Researchers are focusing on using RNA based nanoparticles for specific targeting of cancer cells and direct delivery of drugs to the affected cells. Initial research is targeting ovarian cancer, liver cancer, and leukemia.

UC researchers created a new process, called lipid vesicle fusion technique, to embed a re-engineered nanomotor core into a lipid sheet. Once embedded, the core provided a pathway that enabled double stranded DNA molecules to pass through. Researchers are looking into applying this capability to the delivery of therapeutic agents directly to cancerous or viral infected cells.
Senior Design Projects Focused on Innovative Medical Devices

Capstone projects are required of all CEAS students during their senior year. These senior projects are tailored to each student’s major and focus area and provide firsthand experience that demonstrates the knowledge they have gained in their studies at UC. In a number of cases, these projects have resulted in patents and full time positions after graduation.

Senior design students undertake project ideas that address a current problem in their field. Students with similar interests often work in teams. They have two quarters to do research, develop and complete their projects. For some students this means going to competitions, for others, the projects define a solution and validate an innovative approach that is then turned over to industry professionals for commercialization.

Following are two of the current projects under development by CEAS students.

The Hepato Seal

Rachel Rheaume and Will Abner, both biomedical engineering majors focusing on device innovation, designed a medical device for their senior capstone. Bobby Garfield, an industrial designer, assisted the team in developing their concept.

The problem they addressed was “how to reduce the amount of blood loss in the liver during surgery.” Current procedures use devices that are designed to seal liver tissue to prevent bleeding. However there is not a single device that dissects and seals the tissue correctly.

Some devices have been created but do not seal properly to maintain homeostasis in the patient resulting in surgeons doing a lot of switching of devices during surgery. This presents a problem because it prolongs the operation time and extends the amount of blood loss by the patient.

“You want a device that does what it is supposed to do successfully. We saw a lot of surgeries that were using these devices and they accomplished the task, but they didn’t optimize. It wasn’t the best result for the patient,” states Rheaume.

The team’s first step was to meet with a surgeon from University Hospital and present their problem to Dr. Steven Rudich, a hepatobiliary surgeon and the team’s clinical adviser, worked out details with the students. Dr. Rudich provided Rheaume and Abner with a list of things that the device ideally should do. Based on the list, the team had to decide what was realistic and feasible in a single device.

“Meeting with him was the first huge step. Surgeons are the customers — we are the manufacturer. We are looking at what he wants and what he needs. If we don’t give him what he wants and needs we don’t have a product. This really guided us where we needed to go,” says Rheaume.

The basis for their design is called a Kelly clamp. This is the device currently used in open surgical procedures. The team worked to try and replicate this device for use in a laparoscopic surgery. Laparoscopic procedures have several advantages over open surgery including a lower rate of infection, a smaller incision and generally lower costs and faster patient recovery times.

The team added monopolar and bipolar sealing capabilities to the Kelly clamp to meet Dr. Rudich’s needs. Monopolar seals tissue in the liver and bipolar seals vessels in the liver. Both use electricity flowing through the Kelly clamp to seal tissues and vessels thereby preventing further bleeding from liver dissection.

Their innovative device allows the surgeon to dissect the liver using a standard Kelly clamp, flip a switch and use monopolar sealing on the tissue of the liver, then flip it again to use bipolar sealing on the vessels within the liver. “We wanted to streamline the amount of equipment in the operating room as much as we could,” said Abner.

Abner credits this project as the key factor for landing him a full time job at Device & Implant Innovations in biomedical engineering research and development. Rheaume has earned a position with Boston Scientific as a research and development engineer.

CEAS Faculty advisers for the team were Mary Beth Privitera, an industrial designer and Director, M.D.I.E.P, (Medical Devices Innovation Entrepreneurship Program) and Dr. Bala Haridas an engineer and professor in biomedical engineering.

The Ischiban

Biomedical engineering majors Pooja Kadambi and Scott Robinson, along with computer engineer Joe Lovelace and industrial designer Alex Androski, make up another senior design project group looking into creating a device for effectively diagnosing strokes.

Two types of strokes can occur, clots and bleeds. Clot strokes and bleed strokes have opposite treatments — treatment of one type will kill you if you have the other! To determine which type of stroke a patient may have had it currently takes hours of tests and scans before doctors can safely administer the right medicines.

A company in Boston created a system that is a new a way of diagnosing strokes. This senior team was asked to design the contact portion of the system that will be placed on a patient’s head so that the system can determine the type of stroke within five minutes.

The device works by sending a signal from front of the head to the back of the head measuring impedance through the brain. If there is low conductivity it indicates the clot or ischemic stroke. If there is high conductivity the bleed or hemorrhagic stroke is indicated.

The challenge they faced was to create a device that would be sensitive enough when put in contact with the skin to run the test. As an additional consideration, the team wanted to avoid shaving the patient’s head as part of the system’s use. The answer to both concerns is an innovative gel delivery system. Gel allows the unit to penetrate up to two inches of hair on the patient while still obtaining an accurate read.

Lovelace, the electrical engineer of the team, designed a system that checks the impedance to make sure the flow is uninterrupted and running directly from the brain waves to the electrodes. A signal alerts the tester if one of the electrodes is out of place and then another when all of the electrodes are secure and the patient is ready to be tested.

Based on the EEG readings, the device has already been requested by several neurosurgeons for use in patient monitoring over longer periods. Kadambi has been offered a fellowship to continue clinical testing on the device in the emergency medicine field and both Robinson and Lovelace have secured full time positions in their field after graduation.

Rachel Rheaume and Will Abner, work on the Hepato Seal clamp

Pooja Kadambi, Scott Robinson and Joe Lovelace display their stroke diagnostic device
Annual BUV Competition Challenges Students

Saturday, April 16, CEAS students Ryan Barker, Joe Burnett, Ben McFarland and Brad Morgan competed in the Institute for Affordable Transportation’s (IAT) Basic Utility Vehicle (BUV) Competition held in Indianapolis, Indiana.

Team members with their BUV, (L-R), Ryan Barker, Brad Morgan, Joe Burnett and Ben McFarland.

The team had a budget of $1,600 that was supplemented by their sponsors. General Tool Company and Johnson-Melloh are just two of the supporters providing either cash, expertise or machine time to further the project.

Last year, UC placed third in the competition and this year’s team hopes to win out against the competition. Other schools entered in the competition from the area include Valparaiso, Purdue and the University of Missouri.

At the competition, ten to twelve teams bring their A-game hopeful of having designed the top BUV. Before selecting the top design and awarding prizes, each basic utility vehicle is put to the test in a series of events to exercise the vehicle’s abilities. The tests include acceleration, an agility course, a mud pit, an obstacle course, and a mogul run. If that isn’t punishment enough, the vehicle must pass an endurance test that lasts two hours.

Judges include professors, industry engineers and executives from companies in the field. Scoring for the competition is as follows: 20% for implementation of the transmission and power train, 20% for the final BUV cost, 40% load and distance capability designed into the vehicle, 10% for the tests mentioned above and 10% for the oral presentation given by the team as well as complying with the specifications of the vehicle requirements.

Their presentation must include all details of the team’s building process. This includes everything from materials and break down of the system to the assembly process and a risk analysis.

When designing their vehicle, the team must consider the following: overall design and assembly simplicity, durability, maintenance issues, utilization of off-the-shelf components, safety, reliability, minimal cost (of acquisition and operation), center of gravity for maximum stability, tools required and the overall number of parts. If adopted by IAT, the vehicle design will be used in production in third world countries around the globe -- often in rural and undeveloped areas.

“One thing we did to make it more user-friendly was to build as much as we could using bolts instead of welding since electricity and machinery are often not an option where the BUV would be built and used,” concluded McFarland.

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