MOMENTUM

Spring 2014

Big IDEAS

for advancing technology

Meet Team Primer...

A group of mechanical engineering undergrads at the University of Houston Cullen College of Engineering will be competing in the upcoming Shell Eco-marathon in Houston from April 25th to 27th. The 12-member team is currently building an ultra energy-efficient, battery-powered vehicle from the ground up. Team Primer will enter their vehicle, named "EcoPrimer," under the marathon's "prototype" class, focusing on maximizing the car's efficiency rather than the driver's comfort. The team members' tireless work on "EcoPrimer" will double as their senior Capstone Design projects, the penultimate project for all graduating seniors at the Cullen College.

Team Primer is currently sponsored by the Department of Mechanical Engineering at the UH Cullen College of Engineering, the UH Engineering Alumni Association, Zoltek, the American Bureau of Shipping, and the United States Business Council for Sustainable Development (USBCSD).

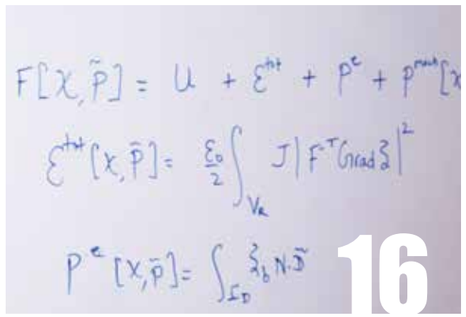
Track Team Primer's progress with us by visiting www.ecoprimer.org.

5

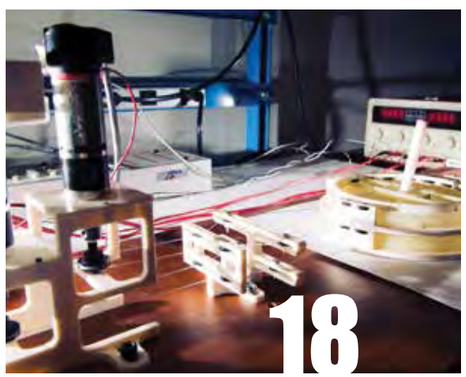
6

11

14



16



18

12

MOMENTUM

Momentum is published biannually by the University of Houston Cullen College of Engineering, Office of Communications.

Director — Audrey Grayson
Contributing Writer — Toby Weber
Contributing Editor — Melanie Ziems
Graphic Designer — Rachel Ward
Photography — Jacob Brown

Office of Communications
Cullen College of Engineering
University of Houston
E301 Engineering Bldg. 2
Houston, Texas 77204-4009

Phone: 713-743-4220 Fax: 713-743-8240

Contact ME:

Phone 713.743.4500

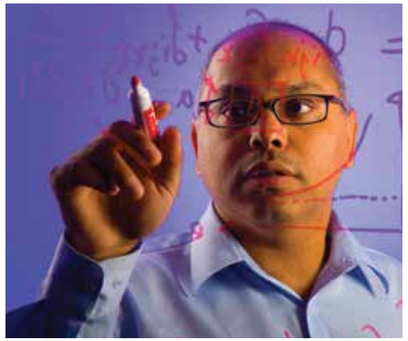
Website www.me.uh.edu

cullen college news

@uhengineering

UNIVERSITY of HOUSTON
CULLEN COLLEGE of ENGINEERING

Letter from the **Chair**



In the Mechanical Engineering (ME) Department at the University of Houston Cullen College of Engineering, our central mission is to educate the next generation of globally competitive engineers and to perform cutting-edge research in the broad area of mechanical sciences. In this issue of Momentum, we invite you to explore the ways in which we continue to succeed in this mission and to take a closer look at our plans to continue driving the field of mechanical engineering forward for generations to come.

A modern mechanical engineer is very versatile. In our department alone, our students and faculty are currently involved in research related to cell biology, drug delivery, missile design, radiation-hardened materials, quantum dots, hypersonic flights, shale gas exploration, nanostructured Li-ion batteries for energy storage, environmentally friendly engines, high temperature superconductive materials, sensors, artificial muscles, and ultra-strong materials. This abbreviated list of active research within our department should give you at least a glimpse at the amazing array of career and research choices a mechanical engineer has in our current economy.

The University of Houston's highly-ranked ME department boasts very close ties with Houston's energy and engineering industrial complex as well as the medical center. Our graduates can be found in key positions in some of the leading companies both locally and around the world.

The ME program has seen record growth in recent years, with an undergraduate enrollment of over 600 students. Mechanical engineering is currently one of the most sought-after degrees within the Cullen College of Engineering.

I invite you to explore our website at www.me.uh.edu to see what we have to offer. If you need more information about our program or department, please email me at psharma@uh.edu.

Pradeep Sharma
M.D. Anderson Professor and Department Chair
Mechanical Engineering
Cullen College of Engineering
University of Houston

By the **Numbers**

BANG For Your BUCK

Forbes List:

America's Engineering Capitals

1. San Jose/Santa Clara *
2. Houston/Harris
3. Wichita/Sedgwick
4. Dayton/Montgomery
5. San Diego/San Diego
6. Greenville/Greenville
7. Albuquerque/Bernalillo
8. Boston/Suffolk
9. Bakersfield/Kern
10. Denver/Denver

*(City/County)

#1

Lowest Cost of Living
+
Lowest Cost of Degree
+
Highest Number of Jobs
+
Competitive Salaries
+
NASA + the Port of Houston +
World's Largest Medical Center +
2nd Most Fortune 500 Companies in the Nation

HINT:

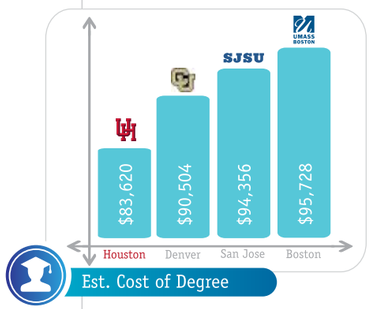
They don't call us the "Energy Capital of the World" for nothing!

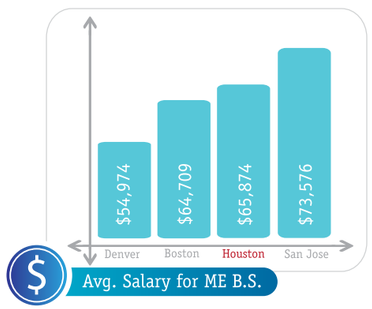
What is a bachelor's degree in mechanical engineering worth in different cities across the country?

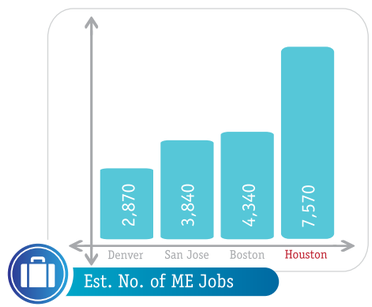
We compare four state universities across the nation to see what an engineering degree will cost you and what your chances of employment are after college in each city. We also take a close look at the estimated salaries for mechanical engineers in each city, as well as the average cost of living.

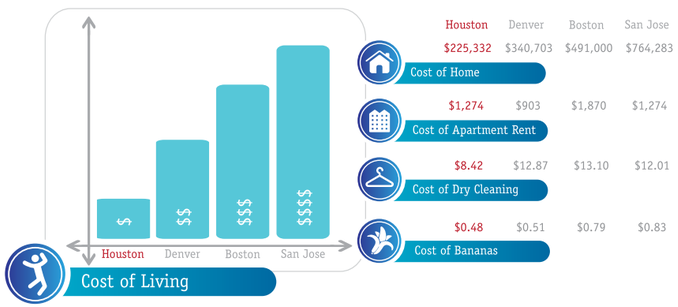
So, in which city do you think your mechanical engineering career might look the brightest?

How It All Adds Up:









Sources: 1. Cost of Degree: Available on Public University Websites 2. Wage Data: (Source: FLC Data Center Wages for 2013- 2014) 3. Employment Data (Source: Bureau of Labor Statistics 2012 Occupational Employment and Wages Data) 4. Cost of Living Data Available at http://www.bankrate.com/calculators/savings/moving-cost-of-living-calculator.aspx

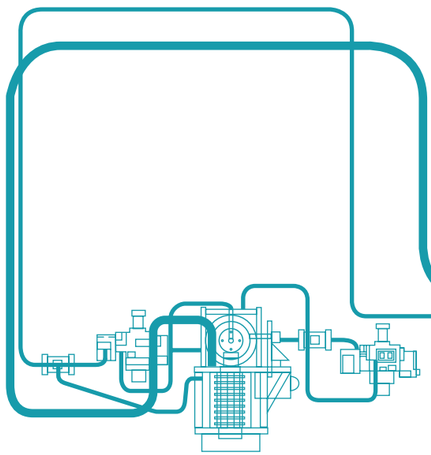
If you care
about **ENERGY.**

you care
about **US.**

World energy demand continues to increase rapidly, and it's indisputable that much of that energy demand will be met by finding new methods of petroleum retrieval, such as drilling in ultradeep water.

Retrieving these resources efficiently and safely is in everyone's best interest. That means worldwide standards must be set for subsea engineering education, which focuses on the equipment and infrastructure used in the underwater portion of offshore petroleum exploration and retrieval. Moreover, university researchers, government regulators and industry representatives are now coming together to set universal safety standards for offshore energy production.

The University of Houston's Cullen College of Engineering has taken the lead in both of these areas, solidifying its status as a key player in defining worldwide standards for both subsea engineering education and offshore energy production safety.



The UH Cullen College of Engineering is the United States' clear leader in subsea engineering education. It started the country's first academic program for the discipline in 2011, and in 2012 began offering the nation's first master's degree in subsea engineering.

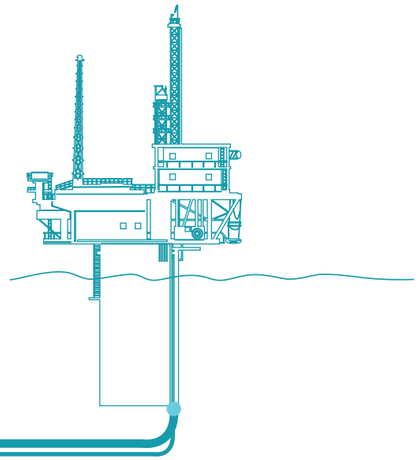
However, the newly emerging field of subsea engineering lacks uniform standards when it comes to the subsea engineering education curriculum. According to **Matt Franchek**, founding director of the subsea engineering program and a professor of mechanical engineering at the Cullen College, the lack of a worldwide standard for a subsea engineering curriculum makes the recruiting and hiring process for subsea engineers very difficult.

"When you're hiring a mechanical engineer, you know what you're hiring. When you hire an electrical engineer, you know what you're hiring. But when you hire a subsea engineer, you don't know what you're hiring. Everybody has their own version or variation," Franchek said.

To remedy this, the UH Cullen College of Engineering took the lead in setting the standard for subsea engineering education across the globe. Leaders with the world's top subsea engineering programs gathered at the University of Houston last May for the first meeting of the Global Subsea University Alliance, a group dedicated to establishing worldwide standards for subsea engineering education.

The alliance seeks to establish a global subsea curriculum in coordination with companies that operate in the sector. The first step, Franchek said, is a course-by-course, lecture-by-lecture evaluation of the world's top subsea engineering programs, all of which belong to the alliance. In addition to the University of Houston, these include programs at Curtin University (Australia), Federal University of Rio de Janeiro (Brazil), the National University of Singapore, the University of Aberdeen (Scotland) and the University of Bergen and the University of Stavanger (both in Norway). All were present at the meeting, as were two major players in the subsea sector, Cameron and FMC Technologies.

Alliance members will then see what these programs have in common and establish a core curriculum for the discipline. They will also determine the strengths of each individual program and form committees to establish standards for specialties, such as flow assurance, subsea processing and system design and control.



As home to the only subsea engineering program in the United States, the Cullen College is an established leader in offshore energy education. So, it only made sense for the UH Cullen College of Engineering to also be a key player in ensuring the safety of offshore energy production for years to come.

The University of Houston will join forces with Texas A&M University and the University of Texas at Austin to form the Ocean Energy Safety Institute (OESI), which will serve as a platform for communications and research among government, academia and industry in the field of offshore energy. The three universities won a competitive five-year, $5 million grant from the Department of the Interior's Bureau of Safety and Environmental Enforcement to establish the institute.

Such partnerships will help bring the college some well-deserved recognition for its contributions in the offshore sector, added **Joseph W. Tedesco**, Elizabeth D. Rockwell Dean and Professor of the Cullen College.

"Offshore resources are going to contribute significantly to energy production in the years to come. The Ocean Energy Safety Institute will play a key role in safely and efficiently developing these resources," Tedesco said. "I'm proud that our researchers are so prominently involved in this initiative and I look forward to seeing their advances adopted by companies in this sector."

ME Hosts State, International Gatherings

Yashashree Kulkarni prepares for PACAM XIII

The ME department served as the first US-based host for the Thirteenth Pan-American Congress of Applied Mechanics (PACAM XIII), which was held in May 2013. The conference was co-organized by Bill D. Cook Assistant Professor **Yashashree Kulkarni**, who served as the conference chair along with mechanical engineering chairman **Pradeep Sharma** as the co-chair.

The aim of PACAM, which is usually held at a Latin American venue, is to provide a platform for bringing together researchers and practicing engineers from North America, Latin America and the Caribbean for discussion of advances in the field of applied mechanics.

This year, the conference attracted over 100 participants from across the Americas and showcased symposia on topics ranging from classical mechanics and materials science to biomechanics and materials for energy. Kulkarni and Sharma also secured funding from NSF to provide travel scholarships to many early-career researchers and graduate students from U.S. institutions to attend PACAM XIII.

Kulkarni and Sharma also co-organized the 3rd Annual Workshop of the Texas Materials Modeling Network (TXMMN), held in December 2013. More than 50 people from five Texas universities attended the gathering. TXMMN promotes the interaction of Texas researchers working on theory, computation and experiments directed at modeling material design, processing, properties and performance.

For more news from the UH Department of Mechanical Engineering please visit: http://www.me.uh.edu/news

GE Oil & Gas Gives College $100K for Scholarships

GE Oil & Gas donated $100,000 to the UH Cullen College of Engineering for undergraduate student scholarships in the mechanical engineering department. For five academic years starting in the fall of 2013, two undergraduates will each receive a one-year scholarship valued at $10,000, along with the title of GE Oil & Gas Scholar. The scholarships can be renewed, provided that the recipients meet specific academic benchmarks. As GE Oil & Gas Scholars, the students will also get an early look at the world of professional engineering. They will be invited to visit GE Oil & Gas facilities in the Houston area, where they can meet with company executives and members of its engineering team. The winners will also have the opportunity to work with the company on research projects through internships.

City of Houston Honors UH STEM Center, Center Director

December 3, 2013 is officially UH STEM Center/Dr. Bonnie J. Dunbar Day in the City of Houston. Houston Mayor Annise Parker proclaimed the honor during a ceremony at Houston City Hall. The proclamation is sponsored by Houston City Council Member Melissa Noriega. It honors the University of Houston center dedicated to improving scientific literacy and encouraging young people to enter the STEM fields (science, technology, engineering, mathematics), as well as the center's leader, former astronaut and M.D. Anderson Professor of mechanical engineering Bonnie Dunbar.

Nanomedicine Research Gets Joint Fellowship

One graduate student will have the opportunity to work on a collaborative cancer research project in two labs thanks to the Houston Methodist Research Institute (HMRI) Graduate Fellowship in Translational Research. The fellowship has been awarded to assistant professor of mechanical engineering Ashutosh Agrawal, as well as Lidong Qin of HMRI's Department of Nanomedicine. The award will be used to support a graduate student shared by their two research groups. The student will contribute to the researchers' efforts to create novel nanoparticle-based drugs for early diagnosis and treatment of breast cancer. This project calls on Agrawal's expertise in theoretical biophysics and Qin's in medical microfluidics. For more information please visit: http://www.egr.uh.edu/clinical-translation-fellowship

In the Media Spotlight

Bonnie Dunbar Talks Space Program on MSNBC's "Melissa Harris-Perry Show"

Bonnie Dunbar, director of the UH STEM Center and the aerospace engineering program as well as M.D. Anderson Professor of mechanical engineering at the UH Cullen College of Engineering, was featured on MSNBC's live news program, the Melissa Harris-Perry Show. The discussion centered on the U.S. space program and whether the government currently contributes too much, or not enough, funding to the program. The conversation also covered how we can encourage more young women to enter into STEM fields.

Larry Bell and Bonnie Dunbar Discuss Re-Engineering Space Program in Forbes.com Column

Larry Bell, director of the world's one and only space architecture graduate program at the University of Houston, discusses how to re-engineer the space program in the United States with former astronaut and M.D. Anderson Professor of mechanical engineering Bonnie Dunbar in his Forbes.com column.

Houston Chronicle and ME Professors Look at Mechanical Engineering Job Growth

According to a recent article in the Houston Chronicle, engineering students with a concentration in mechanical or robotic engineering can look forward to a healthy job market when they graduate. The Chronicle spoke to Dong Liu and J.R. Rao, both associate professors of mechanical engineering at the UH Cullen College of Engineering, about the increase in job prospects for ME students.

'There are no textbooks': Cullen College's Subsea Engineering Program Featured in DecomWorld

Matthew Franchek, director of the nation's first-ever subsea engineering graduate program at the UH Cullen College of Engineering, spoke with DecomWorld about the efforts underway at the college to establish standardized curricula for the subsea engineering field so that both students and employers know what they're getting from a subsea engineering degree and how this new field of knowledge is racing to meet the challenges presented by deep water hydrocarbon production.

Matthew Franchek Featured on "The EnergyMakers"

Matthew Franchek, director of the subsea engineering graduate program, was interviewed on The EnergyMakers show, a weekly video podcast/broadcast presented by NRG Energy. Host Russ Caper discussed underwater cities, the autonomous vehicles that maintain these cities, and the curriculum of the program that prepares engineers for a career in subsea engineering with Franchek.

UH Students, Faculty Receive National Media Attention for Their Ride in NASA's "Vomit Comet"

A team of engineering undergrads at the Cullen College received national media attention when they were chosen by NASA to design, build, fly and evaluate an experiment while aboard NASA's reduced gravity aircraft known as the "Vomit Comet." With a little help from associate professor Dong Liu and his graduate students, who are also mentioned in the media coverage, the student team was able to successfully perform their experiment – to freeze water in a reduced gravity environment – while floating weightlessly aboard the aircraft.

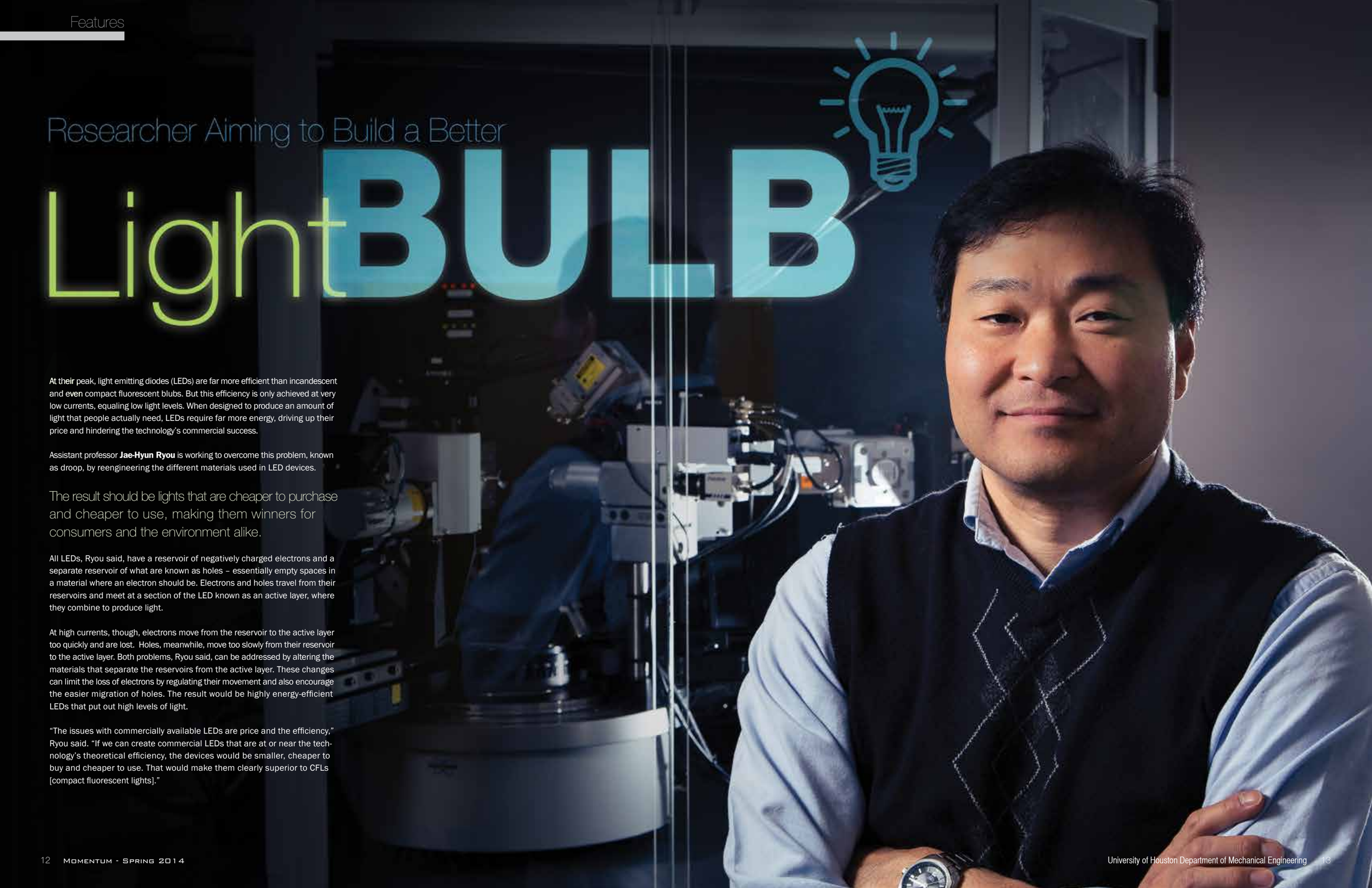
Rigzone Spotlights Subsea Engineering Society

The University of Houston's Cullen College of Engineering Subsea Engineering Society continues to gain recognition, this time as the focus of an article by Rigzone, titled "UH Dives Deep to Advance Subsea Engineering."

For more Cullen College news in the media, please visit: http://www.egr.uh.edu/media-coverage

Researcher Aiming to Build a Better

LightBULB



At their peak, light emitting diodes (LEDs) are far more efficient than incandescent and **even** compact fluorescent blubs. But this efficiency is only achieved at very low currents, equaling low light levels. When designed to produce an amount of light that people actually need, LEDs require far more energy, driving up their price and hindering the technology's commercial success.

Assistant professor **Jae-Hyun Ryou** is working to overcome this problem, known as droop, by reengineering the different materials used in LED devices.

The result should be lights that are cheaper to purchase and cheaper to use, making them winners for consumers and the environment alike.

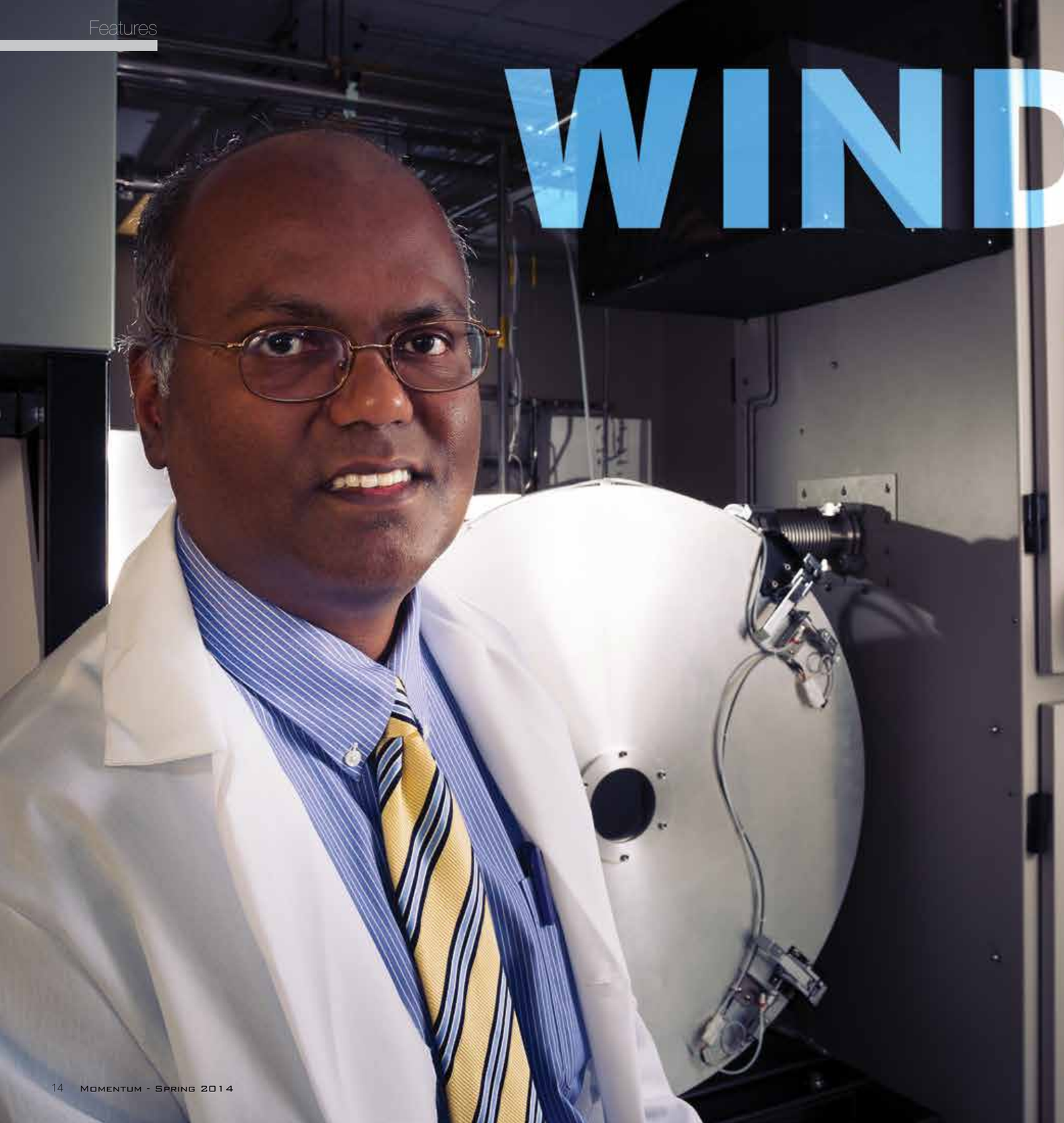
All LEDs, Ryou said, have a reservoir of negatively charged electrons and a separate reservoir of what are known as holes – essentially empty spaces in a material where an electron should be. Electrons and holes travel from their reservoirs and meet at a section of the LED known as an active layer, where they combine to produce light.

At high currents, though, electrons move from the reservoir to the active layer too quickly and are lost. Holes, meanwhile, move too slowly from their reservoir to the active layer. Both problems, Ryou said, can be addressed by altering the materials that separate the reservoirs from the active layer. These changes can limit the loss of electrons by regulating their movement and also encourage the easier migration of holes. The result would be highly energy-efficient LEDs that put out high levels of light.

"The issues with commercially available LEDs are price and the efficiency," Ryou said. "If we can create commercial LEDs that are at or near the technology's theoretical efficiency, the devices would be smaller, cheaper to buy and cheaper to use. That would make them clearly superior to CFLs [compact fluorescent lights]."

WIND, Solar

Getting Boost From Energy Storage Research



The amount of energy produced by solar and wind power changes along with the weather.

Ideally, one moment's surplus electricity could be stored for periods of low production. Existing energy storage devices, though, aren't up to the task. They typically lose a significant amount of energy during storage and cannot distribute electricity as quickly as needed.

M.D. Anderson Chair Professor **Venkat "Selva" Selvamanickam** is addressing this issue through a grant awarded to Florida-based Tai-Yang Research Company (TYRC). The project, funded with $2.14 million from the Advanced Research Projects Agency-Energy, focuses on developing a Superconducting Magnetic Energy Storage (SMES) technology that stores energy with 95 percent "round trip" efficiency and can quickly discharge the energy it holds.

There are two essential elements to any SMES device. The first is a ribbon of superconducting material that transports electricity without losing any energy in the form of heat. The second is the design of the coil the superconducting ribbon is formed into. As electricity travels through the superconductor, the coil shape converts electric energy into magnetic energy.

While generating a magnetic field is the goal, it also presents a problem. "The magnetic field flux line [essentially the pull of magnetism] that the coil generates can move through and within the superconducting wire," said Selva. "That can hurt the wire's ability to carry electricity and lower overall device performance."

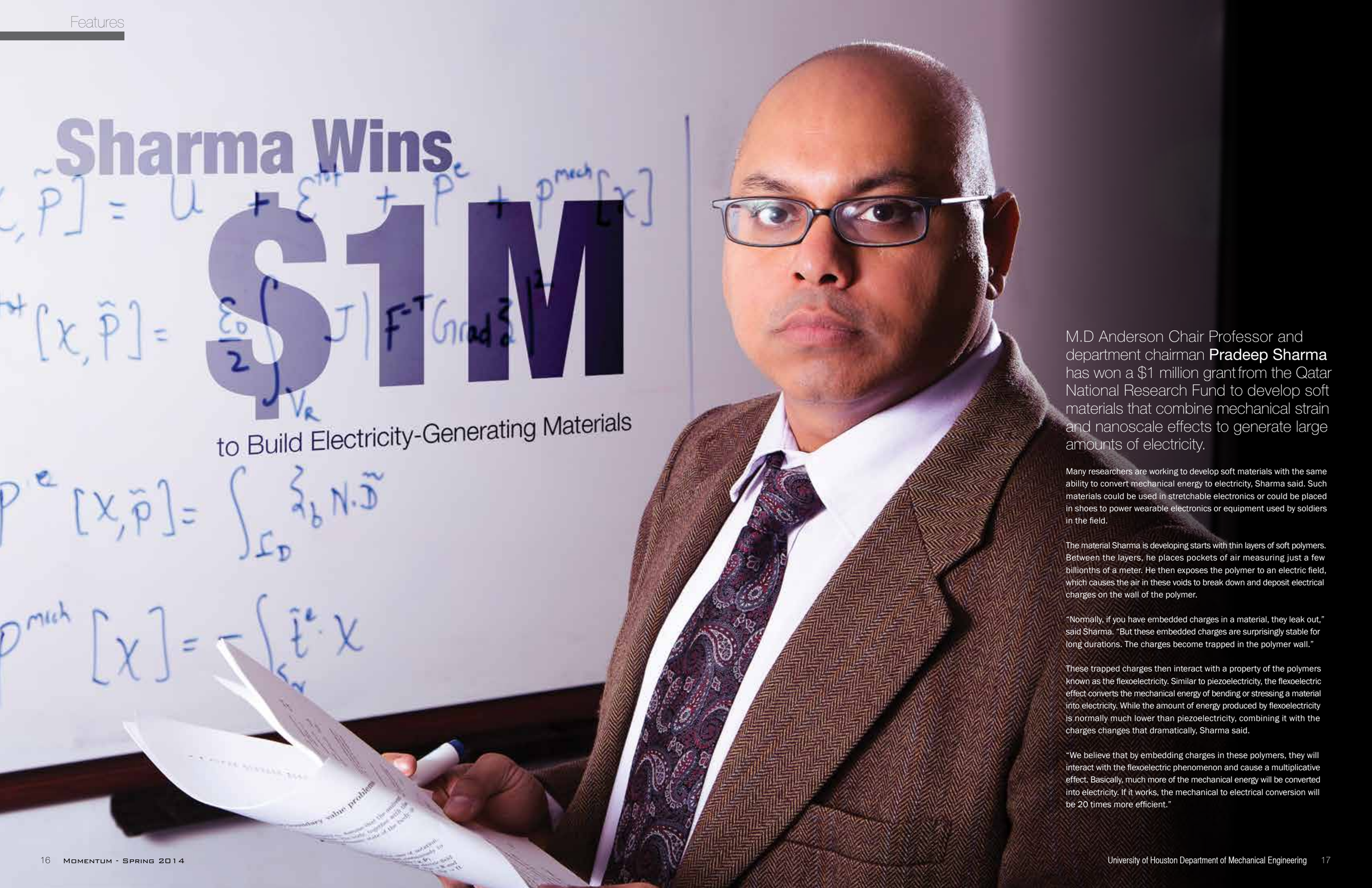
The research team is addressing the problem in two ways. Selva is introducing small defects into the superconducting ribbon. These defects will hold the flux lines in place, allowing electricity to move through the superconductor unfettered.

TYRC, meanwhile, is designing a coil that generates a magnetic field that introduces lower mechanical strain on the superconducting ribbon, limiting the field's impact on ribbon performance.

Combined, said Selva, these advances should improve the storage capacity of existing SMES devices by two- to ten-fold when compared to standard SMES systems.

Sharma Wins $1M

to Build Electricity-Generating Materials



M.D Anderson Chair Professor and department chairman **Pradeep Sharma** has won a $1 million grant from the Qatar National Research Fund to develop soft materials that combine mechanical strain and nanoscale effects to generate large amounts of electricity.

Many researchers are working to develop soft materials with the same ability to convert mechanical energy to electricity, Sharma said. Such materials could be used in stretchable electronics or could be placed in shoes to power wearable electronics or equipment used by soldiers in the field.

The material Sharma is developing starts with thin layers of soft polymers. Between the layers, he places pockets of air measuring just a few billionths of a meter. He then exposes the polymer to an electric field, which causes the air in these voids to break down and deposit electrical charges on the wall of the polymer.

“Normally, if you have embedded charges in a material, they leak out,” said Sharma. “But these embedded charges are surprisingly stable for long durations. The charges become trapped in the polymer wall.”

These trapped charges then interact with a property of the polymers known as the flexoelectricity. Similar to piezoelectricity, the flexoelectric effect converts the mechanical energy of bending or stressing a material into electricity. While the amount of energy produced by flexoelectricity is normally much lower than piezoelectricity, combining it with the charges changes that dramatically, Sharma said.

“We believe that by embedding charges in these polymers, they will interact with the flexoelectric phenomenon and cause a multiplicative effect. Basically, much more of the mechanical energy will be converted into electricity. If it works, the mechanical to electrical conversion will be 20 times more efficient.”

Researcher Develops MRI-Friendly Cardiac Catheterization ROBOT

A team of researchers has designed a robotic platform that can allow doctors to insert a cardiac catheter in a patient inside of a magnetic resonance imaging (MRI) machine.

Currently, cardiac catheterizations are carried out in an operating room, where doctors use MRI images taken before the procedure to guide their work. According to **Karolos Grigoriadis**, David Zimmerman Professor of Mechanical Engineering, this new system would allow them to view the MRI images during the actual procedure, which should improve patient outcomes.

The system, which is named ROBOCATHETER, is capable of positioning and orienting a cardiac catheter while avoiding collision between the interventional tool and the internal organs.

According to Grigoriadis, the platform's compact design allows it to rest on a patient inside an MRI machine and compensate for the motion of the patient's heart during minimally invasive heart surgery.

ROBOCATHETER employs a cable transmission system that transfers torque from conventional electric motors to the robot's joints. These motors are placed far from the MRI and its powerful magnets. The components near the machine are entirely non-metallic. In fact, much of the rest of the device was built with a 3-D printer using acrylonitrile butadiene styrene (ABS), a plastic material that is not affected by the MRI machine.

Grigoriadis' collaborators on this project are Javad Mohammadpour, who completed his Ph.D. at the University of Houston and is currently an assistant professor at the University of Georgia, and recent Ph.D. graduates Amin Ramezanifar and Amirhossein Salimi.

Subsea Professor Wins SPE Teaching Award

Phaneendra Kondapi, winner of SPE Teaching Award

Phaneendra Kondapi, who has helped pioneer subsea engineering education as a KBR Adjunct Professor, was awarded the 2013 SPE Teaching Excellence Award from the Society of Petroleum Engineers (SPE) International. The award recognizes petroleum engineering faculty who have demonstrated innovative teaching techniques and creative pedagogy methods. The purpose of the award is to encourage faculty to excel in the classroom, provide teaching best practices to be shared with other departments, and develop and retain superior faculty.

Kondapi, an engineering manager for flow management at FMC Technologies, has developed his own instructional approach, dubbed the "reverse circular teaching method." With it, Kondapi emphasizes that simply teaching theories to students is not enough. "We have an obligation to our students to connect the dots between theories and the real-world application of those theories," he said.

Kondapi begins each class with a project that asks students to solve a real-world problem. Only after being assigned their big project will Kondapi start in on the theories. "It motivates them to acquire the ideas and solution strategies necessary to figure it out, so that way they have to relate the theories back to the project – we connect the dots between an equation on a chalkboard and what they will be doing every day when they go to work in industry."

In addition, Kondapi said he takes extra steps to prepare students for the "real world." These include inviting industry speakers into the classroom, taking students on flow assurance lab field trips, and asking students to prepare professional project reports and to give presentations in front of industry professionals. Kondapi noted that "this may be the first university-level course in the U.S. that has been designed to meet direct subsea applications with academic standards."

Dunbar Inducted into Astronaut Hall of Fame

Bonnie Dunbar, leader of the UH STEM Center and director of the aerospace engineering program at the Cullen College of Engineering, has joined the ranks of Neil Armstrong and Sally Ride as the latest member of the Astronaut Hall of Fame.

Dunbar, along with Curt Brown and Eileen Collins, was inducted to the U.S. Astronaut Hall of Fame in April 2013 at the Kennedy Space Center Visitor Complex near Orlando, Fla.

Dunbar earned her Ph.D. from the Cullen College of Engineering before embarking on her 27-year-long career at NASA, where she soared into space on the Challenger, the Columbia, the Atlantis, and the Endeavor. While at NASA, Dunbar served as shuttle mission specialist and payload commander for five space flights between 1985 and 1998.

Since her space flight career, Dunbar has devoted much of her time and energy to increasing and fortifying the STEM (science, technology, engineering, and math) pipeline in the U.S., even serving as President and CEO of the Museum of Flight in Seattle prior to joining UH.

Her primary goal as leader of the UH STEM Center is to strengthen and support STEM-related educational programs for children of all ages – from kindergarteners to high school seniors.

"Developing a pipeline for careers in science, technology, engineering and mathematics will play a major role in the sustained growth and stability of the U.S. economy, and is a critical component to helping our nation win the future," Dunbar said. "To address the grand challenges of this great country, we need the new ideas, new companies and new industries created by STEM careers. This has been historically, and will be in the future, the key to great progress in the United States."

Bonnie Dunbar. Photo Credits: NASA

Grigoriadis, Ardebili Honored for Teaching and Research

Two mechanical engineering faculty members were honored by the college last April for their achievements in teaching and research. David Zimmerman Professor of Mechanical Engineering **Karolos Grigoriadis** was honored with the Fluor Corporation Faculty Excellence Award, the highest award given by the college, and the W.T. Kittinger Teaching Excellence Award, the college's most prestigious teaching honor.

His research focuses on dynamic systems and controls, feedback control systems analysis and design, linear and nonlinear systems theory, robust and fault-tolerant control, model reduction, filtering, and system optimization. The applications of this research include the modeling and control of aerospace systems, control of internal combustion engines, active and passive vibration isolation of structural systems, and intelligent biomedical systems.

Bill D. Cook Assistant Professor **Haleh Ardebili** won an Outstanding Professor Award from the college. Ardibili's research focuses on lithium ion batteries, polymer nano-composite electrolytes, lithium ion conduction, materials for energy storage, and electronics materials. In late 2012, she won a National Science Foundation CAREER Award to to explore the fundamental science underpinning flexible, stretchable lithium ion batteries.

Such batteries, she said, could be integrated into textiles or could be worn around the wrist like a bracelet. When sewn into fabric, they could be used to power equipment worn by soldiers in the field or to supply energy to patches placed on the skin and used for medical purposes, such as patient monitoring or diagnostics. A battery worn around the wrist, meanwhile, could be a convenient backup power source, serving as a charger for a smart phone that's low on power, for example.

Alumnus/Professor Featured in NAI Brochure

Cullen College alumnus and adjunct professor of mechanical engineering **Benton Baugh** is featured in the 2013-2014 National Academy of Inventors brochure for inventing a current-secured drilling device called the "Drilling Riser Centralizer System."

Baugh, a member of the National Academy of Engineering and a charter fellow of the National Academy of Inventors, serves as president of Baugh Consulting Engineers, Inc., which provides oilfield-related consulting, patent licensing and expert witness work.

One of the most vulnerable parts of a subsea drilling operation is the drilling riser, which is a conduit that provides a temporary extension of a subsea oil well to the surface drilling facility (or floating drilling rig). In strong winds and currents, the drilling riser becomes unstable and drilling operation must be halted until the weather improves.

With Baugh's Drilling Riser Centralizer System, the riser can remain stable in ocean currents up to 2.88 miles per hour. This not only reduces the risk to the riser and rig, but can significantly reduce the number of lost drilling days due to bad weather conditions.

National Academy of Inventors Honors Superconductivity Researcher

Venkat "Selva" Selvamanickam, M.D. Anderson Chair Professor of Mechanical Engineering and director of the Texas Center for Superconductivity's Applied Research Hub, has been named a fellow of the National Academy of Inventors. The honor is reserved for researchers at universities, nonprofit research institutes or other academic entities who have "demonstrated a highly prolific spirit of innovation in creating or facilitating outstanding inventions that have made a tangible impact on quality of life, economic development and the welfare of society."

Selva brings an entrepreneurial flair to his research. In 2000, eight years after earning his Ph.D. from UH, Selva co-founded SuperPower, which produces superconducting electrical wire. At SuperPower, he led the development of technologies to convert a brittle ceramic superconductor into a flexible wire that has 300 times the current-carrying capacity of a comparably sized copper wire.

His team was the first to manufacture thin film superconductor wire, which was used in 2008 to power 25,000 households in Albany, N.Y., and now is used by more than 200 institutions around the world for applications including wind generators, energy storage, power transmission cables, magnetically levitated trains, medical imaging and defense applications.

When Selva returned to UH in 2008, he brought the research division of SuperPower with him.

In 1996, Selva received the Presidential Early Career Achievement award. He was named Superconductor Industry Person of the Year in 2004 and has received several R&D 100 awards along with numerous other honors. He holds 39 U.S. patents and 13 pending U.S. patents.

Selva is now pioneering the development of advanced processing techniques for high-performance materials for energy and electronics applications, including high-temperature superconducting thin film tapes, thin film photovoltaics and flexible electronics.

Department Chair Travels to India on Fulbright

M.D. Anderson Chair Professor and mechanical engineering chairman **Pradeep Sharma** was awarded a Fulbright Fellowship through the Fulbright Specialist Program, which sends leading academics, professionals, and researchers overseas to conduct seminars, short courses, and engage in other institutional and faculty developmental activities.

Sharma spent 16 days at Delhi University in New Delhi, India last summer to aid in the development of a computational nanoscience infrastructure at the university. During his stay, Sharma conducted introductory short courses on nanoscience and nanotechnology and held research seminars on computational nanotechnology for graduate students.

Additionally, he undertook a comprehensive review of the university's existing educational programs and curriculum in nanotechnology, providing university officials with advice on how to modify the curriculum in order to meet the future needs of engineers entering into this field.

In addition to sharing invaluable nanoscience expertise, Sharma stressed the positive impact this fellowship has for the University of Houston and the United States.

"There is a growing demand for a technically competent, high-quality workforce at the graduate level, especially within the STEM (science, technology, engineering and math) disciplines," Sharma explained. Despite ongoing efforts at the University of Houston and other STEM Centers around the country to recruit and retain more American students into STEM disciplines, there is an enormous gap between the supply of domestically-trained U.S. STEM workers and the demand for them.

This gap can in part be met by helping to train and prepare students abroad for STEM careers in the United States. "Programs such as the Fulbright Fellowship allow us to enable foreign institutes to better prepare their students for STEM disciplines, which, in turn, prepares them to become ideal candidates for graduate study in the U.S," Sharma said. "The University of Houston will benefit from the influx of such high quality graduate students."

Long-time Professors **Wheeler and Kleis Retire**

Lewis Wheeler, who served as a professor in the ME department since 1968, and Stanley Kleis, who joined the department in 1973, both retired last year.

Lewis Wheeler joined the Cullen College of Engineering as an assistant professor in the department of mechanical engineering in 1968. Three years later, he became an associate professor, before becoming a full professor in 1976.

Wheeler's primary research interests include continuum mechanics, mathematical elasticity theory, lattice dynamics and structure. He has supervised the research of over 20 graduate students during his tenure at UH.

An American Society of Mechanical Engineers (ASME) fellow, Wheeler was awarded the 2002 Dean Claude L. Wilson Award for lifetime achievement as an outstanding engineering educator. He also received the ASME's Dedicated Service Award in recognition of his contribution to the Journal of Applied Mechanics as its technical editor. He served as the journal's chief editor for 10 years and was instrumental in shaping the modern version of the journal. Wheeler was also the founding editor of Mathematics and Mechanics of Solids and served in that role for 10 years.

"I learned a lot from Lewis," remarked Pradeep Sharma, M.D. Anderson Chair Professor and department chair. "The foremost was the crystal clear sense of ethics when it comes to the important things of our job... you can always count on Lewis to do the right thing and make the correct decision."

Wheeler graduated from UH with B.S. and M.S. degrees in mechanical engineering in 1963 and 1964, respectively. He received his doctorate in applied mechanics from the California Institute of Technology in 1969.

Thanks to the generosity of Wheeler, the department has established the annual Lewis Wheeler Scholarship for mechanical engineering Ph.D. students. The scholarship carries an award of $1000, along with a certificate. The 2014 inaugural recipients are Afif Gouissem, Aritra Sur and Farah Hammami.

Stanley Kleis joined the mechanical engineering department as a visiting assistant professor in 1973. Two years later, he became an assistant professor, and in 1981, was named associate professor.

"One of the interesting things about Stan is that he is one of the few academics who does advanced Ph.D.- level fundamental research but then, he can go to a machine shop and actually make real gizmos giving any technician a run for their money," said Sharma.

One such invention, the miniature bioreactor for space applications, led to Kleis receiving the highest NASA civilian award, the Public Service Medal. This distinction is given in recognition of exceptional contributions to the mission of NASA by those who are not government employees.

Kleis' primary research interest has focused on turbulent shear flows and fluid mechanics, solid-liquid two phase flows, mass transfer in micro gravity, and stratified flows. He has advised over 30 graduate students and has published 57 papers during his tenure at UH.

A highly-regarded teacher, Kleis received practically every major teaching honor awarded by the college and the university, as well as and several Professor of the Year awards from the American Society of Mechanical Engineers (ASME) student chapter.

Kleis received his B.S., M.S., and Ph.D. degrees from Michigan State University in 1967, 1968, and 1974, respectively.

College Mourns Passing of Distinguished Research Professor, NAE Member Michael Pao

Yin-Ho Michael Pao, Distinguished Research Professor of mechanical engineering with the University of Houston Cullen College of Engineering and a member of the prestigious National Academy of Engineering, died last September from heart complications.

Pao, who received a Ph.D. in fluid mechanics from Johns Hopkins University in 1962, had a long association with the college's mechanical engineering department and an incredibly successful career as an entrepreneur and businessman.

He founded and led six technology companies in his career, three of which he took public on the NASDAQ stock exchange. One of these, Flow International Corp., was named the third-best performing initial public offering in the nation in 1983 by the financial publication Barron's. That firm developed and commercialized the use of ultrahigh-pressure water-jet and abrasive-jet technology for industrial cutting, drilling and milling, and is credited with creating the water-jet machining industry.

His most recent venture was Floating Windfarms Corp., which he founded in 2005. True to its name, that firm specializes in the development of offshore wind farms that utilize vertical axis turbines.

Pao's efforts earned him membership in the National Academy of Engineering. The official citation for his induction recognized his "research, development, and commercialization of water-jet technology for machining, trenchless boring, and surface preparation."

Joseph W. Tedesco, Elizabeth D. Rockwell Dean and Professor, recalled Pao as one of the Cullen College's biggest supporters.

"Dr. Pao was an extremely accomplished individual who was also one of the best friends the Cullen College could ask for. Through his insights on science, technology, and trends in the world of business and industry, he was an incredible person to have on our side. He will be deeply missed by everyone here," he said.

Mechanical Engineering Department Seeks Ph.D. Students From France

The Department of Mechanical Engineering at the Cullen College is currently looking for the best and brightest graduate students from France.

In an agreement known as Cotutelle, the University of Houston will be partnering with universities across France to offer dual Ph.D. degrees to a select group of high-achieving students. These students will be jointly supervised from the two universities, but will only be required to write one dissertation.

"Students earning the dual Ph.D. find their international experience places them ahead of the game in a job search and exposes them to new cultural and research environments," explained **Ken White**, professor and graduate director in the Cullen College's ME department.

Last year, White travelled to St. Etienne (ENISE), the University of Poitiers, UTC in Compiegne, and IMEP-LAHC and LMGP labs in Grenoble. "Armed only with a presentation of our mechanical engineering department's research interests and funding levels, my initial pass through France returned several possible matches between existing projects at both ends," White said.

To date, White said that three working projects are evolving and more are likely. For these three, the Cotutelle agreements are in the works, very high quality students have been identified and faculty have already exchanged technical ideas and seminars with each other and their colleagues.

Industry Feedback Spurs Changes to ME Undergrad Curriculum

Over the last year, a department committee led by professor Rick Bannerot has worked to propose significant enhancements to the B.S. degree program within the mechanical engineering department at the UH Cullen College of Engineering. These changes are driven in large part based on inputs received from the ME department's Industrial Advisory Board and alumni.

Specifically, two formerly elective courses will now be required for the completion of a mechanical engineering bachelor's degree – one in finite elements, taken during junior year, and another in machine design, taken during senior year. These new course requirements will take effect starting in the fall of 2014.

Faculty Updates:

Karolos Grigoriadis has been named David Zimmerman Professor of Mechanical Engineering (left).

Dong Liu is now an associate professor with tenure (right).

Faculty Openings:

The Department of Mechanical Engineering at the UH Cullen College of Engineering is currently holding an open search for a **tenured or tenure-track faculty position in Fluid Mechanics**. For more information, please visit: http://www.uh.edu/provost/fac/faculty-openings/mece16/index.php.

The Department of Mechanical Engineering at the UH Cullen College of Engineering is currently holding an open search for a **tenured or tenure-track faculty position in Thermal Sciences**. For more information, please visit: http://www.uh.edu/provost/fac/faculty-openings/mece15/index.php.

New Faculty:

Cunjiang Yu, Assistant Professor
Office Location: Engineering Building 1 N206
Phone: 713-743-4487
Email: cyu13@central.uh.edu

Research Interests: Flexible/Stretchable Electronics, Micro-Electro-Mechanical Systems (MEMS), Nano-Micro-Macro Manufacturing, Additive Printing, Biomedical Electronics and Sensors, Micro-Nano Materials and Devices, Solid State Electronics, Energy Harvesting and Storage.

Biography: Dr. Yu joined the UH Cullen College's Department of Mechanical Engineering in 2013. Prior to joining the ME faculty, Yu served as a post-doc in the Materials Science and Engineering Department at the University of Illinois, Urbana-Champaign. Yu received his Ph.D. in mechanical engineering from Arizona State University.

For more information on Dr. Yu's research group, please visit: http://yu.me.uh.edu.

Aerodynamic: Aerospace Engineering Grad Student Researches at NASA

Priyanka Cholleti at the NASA Johnson Space Center

During her last summer as a graduate student in the University of Houston aerospace engineering program, **Priyanka Cholleti** completed an internship at the NASA Johnson Space Center. For Cholleti, the internship was the realization of a lifelong goal.

Cholleti knew she wanted to be an astronaut when she was in the fifth grade; she participated in a young astronauts program as part of a group of seven other aspiring astronauts who were on a "voyage to Mars." They communicated with "mission control" via video conference while conducting experiments.

"We had suits and helmets, and we walked through the school on mission day, and that's when I thought, 'This is what I want to do.'" Cholleti recalled.

As a graduate student, Cholleti interned with NASA to research fluid dynamics. Her primary task was studying the various forces and load distributions upon re-entry of the Orion capsule.

Previously, she had conducted research on wind turbines with mechanical engineering professor Ralph Metcalfe, but upon her arrival at NASA, there was still much to learn – namely, programming.

"When I joined NASA, I hadn't used the program for coding language, so when I got here I learned C++ and Python," Cholleti said. "I had to know those programs in order to learn the software they wanted me to use. It was super challenging."

Cholleti was new to parallel computing, but taught herself open-source code to run simulations, essentially creating a program to feed into NASA's own computational fluid dynamics (CFD) solvers. She created a model and simulation of a wave tank, incorporating paddles to create different types of waves.

Cholleti's work in fluid dynamics is an example of the flexibility of the aerospace engineering program at UH. Because it is interdisciplinary, students gain knowledge in various areas of engineering, from subsea to wind energy. There are abundant opportunities to specialize in particular areas, and internships in Houston allow students to apply research skills that solve problems.

Materials Engineering Ph.D. Student Awarded Scholarship

Narayan Das Khatri, a Ph.D. student in the department of mechanical engineering at the Cullen College, received a $10,000 Graduate Scholar Award from Golden Key International Honour Society in May 2013. The Graduate Scholar Award is Golden Key's premier scholarship award, with criteria emphasizing high achievement in academics, leadership and service.

Khatri was inducted into Golden Key in the fall of 2009 and became the graduate vice president of the UH chapter of Golden Key in January 2011. In June 2012, Khatri was elected as a representative of the student body of all Golden Key chapters in Region 7.

"This award is indeed recognition of the campus and community around me who helped me make this happen. I believe this would not have been possible without the support of so many of my friends, colleagues, and professors who have been with me for the past few years," Khatri said.

Khatri works under the guidance of M.D. Anderson Chair Professor Venkat Selvamanickam in materials engineering. The focus of Khatri's research is rare earth cuprate high temperature superconducting (HTS) materials. HTS materials carry electricity without electrical resistance, resulting in zero energy loss during transport, and potentially impacting all aspects of energy, including transmission and storage.

With the introduction of nano-scale defects, current carrying capacity of HTS materials can be significantly improved in an external applied magnetic field, as these defects pin the magnetic flux lines from moving, which otherwise would hinder the current flow. Selvamanickam's group recently developed a new method of introducing long-length pre-fabricated nanodefects into the superconducting materials. This method is different from the conventional method where the nanodefects are grown in-situ rather than ex-situ. Because of pre-fabrication, this method provides the opportunity to control the nanodefects parameters such as diameter, length, spacing between nanodefects and their orientation.

Khatri is also studying the nucleation and growth mechanism of superconducting film to understand the role of substrate morphology in the growth of superconducting films. The group is examining which secondary phases are grown in stages of the growth process, and how they may be controlled. The secondary phases have significant influence on current carrying capacity of HTS materials and adversely affect the performance of HTS.

Students Start **First Subsea** Engineering Organization

Subsea engineers are responsible for multi-billion dollar offshore petroleum exploration interests, so it's surprising that there's been no organization dedicated to serving these engineers – until now.

In September, a group of ME students from the UH Cullen College of Engineering started the Subsea Engineering Society (SES), the first organization for experts specializing in underwater petroleum exploration and production.

SES was founded by **Nebolisa Egbunike**, a then-senior mechanical engineering student who is now pursuing a master's degree in the college's subsea engineering program, the first such program of its kind in the country.

Egbunike was looking to join a group that specialized in subsea engineering, but found a lack of an association that focused exclusively on his field – so he decided to start one on his own. "I felt there was a huge gap between students and industry, and that starting an organization would be a way to create a network between professionals and students," he said.

Egbunike took the idea to last year's Offshore Technology Conference and he said the businesses he met with showed immediate interest in the project. "Within two days I had companies asking when we could start working on this. At that point I knew it was going to become a real organization."

In the months since, SES has rapidly gained members. BP signed on as the group's first official major sponsor, while other firms are offering guidance and manpower in the form of speakers and mock interviewers. Phaneendra Kondapi, KBR Adjunct Professor in the subsea engineering program and an engineering manager with FMC Technologies, serves as SES's founding faculty advisor. Egbunike plans to eventually expand SES to include other university and professional chapters as well.

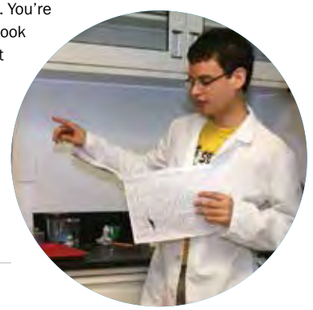
Experiential Learning: Undergrad Research in Energy Storage

David Pineda (pictured below), a mechanical engineering senior, gained practical experience in research methods and a newfound interest in the science of innovation last summer at the UH Cullen College of Engineering. Pineda worked in assistant professor Yan Yao's newly-created Laboratory of Energy Materials and Devices on a project studying the construction of a vanadium redox flow battery system.

Similar to a fuel cell, the vanadium reduction-oxidation ("redox") battery comprises a power cell in which electrolytes flow from external tanks into the central stack where reactions take place and electrons are created. The focus of Pineda's project is to create a platform, or small scale vanadium redox battery, for the development of inexpensive, novel materials used to replace electrolyte solutions and membrane.

However, the vanadium redox flow battery hasn't been widely applied due to its high cost. The price of the active material, vanadium, rises with high demand in the steel industry. Additionally, the cost of the proton exchange membrane (the component inside the central stack where positive ions flow to the negative side, creating a complete circuit) accounts for about 40 percent of the overall cost. The goal is to produce cost-effective materials that allow more efficient permeation of ions.

Pineda's research is self-managed, and the ability to direct the research is something that motivates him. He emphasized that research is a very open, non-linear, improvisational process. "A lot of the things you do in research haven't been done before. You're on your own; you can't go to a textbook and find a solution. It's not easy but it's rewarding if you put in the time and effort. Get a clear picture of how your field applies to real life. Start reading about research that's going on here and other places. Be knowledge-hungry. The best way to learn is by experience itself."



Engineering Students Travel to **Brazil for Outreach**

Members of two UH organizations brought engineering to Brazilian high school students last month as part of their global outreach efforts.

"One Day in Engineering" was planned by **Gabriela Bernardes**, mechanical engineering student and Society of Women Engineers (SWE) Outreach Chair; **Ingrid Arambula**, chemical engineering student and SWE-UH President; **Analicia Caylor**, petroleum engineering student and SWE-UH VP External; and **Zarina Hudaybergenova**, petroleum engineering student and President of the Society of Petroleum Engineers UH chapter.

The event took place in the town of Teresopolis, near Rio de Janeiro. Approximately 100 high school students from five area schools participated in workshops and practical applications of engineering principles, designed to demonstrate the opportunities in engineering careers.

For mechanical engineering, they learned about friction forces and balance by designing a device to rapidly carry a ping pong ball across a zip line. For electrical engineering, students were introduced to electronic concepts with circuit bingo. Chemical engineering was represented with principles of heat transfer by making ice cream, and petroleum engineering was demonstrated with porosity using beads and a jar.

SWE-UH has been recognized by the Engineering Alumni Association for the Best Outreach Event Award two years in a row. The group wanted to expand their outreach efforts to an international level, and "One Day in Engineering" was planned in collaboration with Projeto Social Nadir Furtado, a non-profit organization in Brazil that offers support, counseling and workshops to families in the community. Bernardes is from Brazil, and her family runs the charity, which was created by her grandmother 40 years ago. Word about the event spread throughout the town, and the group could see a positive impact.

Caylor became interested in engineering after she took part in a similar outreach event as an 8th grade student. "Engineering seemed more substantial, more interesting, more challenging," she said. She was convinced that petroleum engineering was the right choice for her when a representative from the Society of Petroleum Engineers visited her school. "I thought that was the coolest thing, combining geology, chemistry and math," she said.

The group is already planning this summer's trip to Brazil.

UNIVERSITY of HOUSTON | ENGINEERING

UH Cullen College of Engineering
Department of Mechanical Engineering
N207 Engineering Building 1
Houston, Texas 77204-4003

MEET *Ryan Hannemann,*

a mechanical engineering student who won this year's Outstanding Senior award from the Cullen College of Engineering. After finishing high school, Hannemann spent six years in the U.S. army – including a combined 33 months on deployments to Iraq – before deciding to pursue his engineering degree at UH. Being the first in his family to graduate college, Hannemann stressed the impact the Cullen College's career fairs and alumni network had on his success in landing a full-time job months before he even graduated. "People don't know how powerful of a network we really have here, and it's based largely off being in this epicenter," he said. Hannemann took full advantage of the resources at UH, working three internships with DuPont and then securing an internship with Marathon Oil in the summer of 2013. After he graduates summa cum laude in May, he'll sign on to work there full-time. Not long after, he and his wife Vanessa will welcome their first child.

YOUR SUPPORT MATTERS TO STUDENTS LIKE RYAN!

Gifts to the UH Department of Mechanical Engineering help fund much-needed scholarships for our students, renovations to our labs and facilities, and the activities of our student organizations. Thank you for continually helping us meet these needs!

Give online at https://giving.uh.edu/eng.