University of Houston Cullen College of Engineering

[ParamETErs]

Fall 2007

emerging ENERGY SOLUTIONS

DEAN'S MESSAGE

A Time of Transition

As we continue to move forward, the Cullen College of Engineering can take pride in all that we've accomplished over the last decade. After nine years as dean of engineering, Raymond Flumerfelt recently stepped down from his leadership position. We are pleased to have Joseph W. Tedesco, chair of the Department of Civil and Coastal Engineering at the University of Florida, join us on Jan. 1, 2008 as the college's sixth dean (learn more about him on page 4).

Flumerfelt's tenure as dean was very successful and his achievements are reflected clearly in the numbers. Under his leadership, external research expenditures doubled; the number of Ph.D. students graduated in our college has also doubled since 1998; and our standards for undergraduates have increased. He led the creation and launch of many new programs and offices designed to ensure the success of our students, such as the Industrial Scholar Interns Program and the Engineering Career Center. To better meet community and industry needs, he initiated various leadership and advisory boards throughout the college that strengthen our ties to the Houston area. I speak for everyone in our college in thanking him for his leadership and wishing him well in the future.

Incoming Dean Tedesco and I will stay in regular contact in the coming months to provide him with the information he will need to "hit the ground running" in January. This will require a period of reflection and self-study that will enable us to best enunciate the strengths that exist within our college and the challenges that lie before it.

We will continue our efforts to recruit high-quality undergraduate students to the college through outreach events, cooperative work with the university's Honors College and by providing competitive scholarship packages. In addition, we will continue to emphasize our Ph.D. programs, while at the same time offering master's level programs with wide appeal to the people of the greater-Houston area.

Finally, we continue to make great strides in the area of research. We have well-respected programs in numerous fields, including materials science, nanotechnology and energy—the last of which is the focus of this issue of *Parameters*.

I am also pleased to announce that our college is leading the Lone Star Wind Alliance, which was recently awarded funds from the State of Texas and the U.S. Department of Energy to open one of only two large wind turbine blade testing facilities in the country (see page 5).

I want to thank everyone in advance for assisting me during this transition period as we look forward to welcoming Joseph Tedesco as our new dean in January.

Sincerely,

Frank J. "Fritz" Claydon
Interim Dean
Professor of Electrical and Computer Engineering

pa·ram·e·ter
Pronunciation: pə-'ram-ə-ţər
Function: noun
Etymology: New Latin, from para- + Greek metron measure
Date: 1656

1: *a.* an arbitrary constant whose value characterizes a member of a system (as a family of curves); also: a quantity (as a mean or variance) that describes a statistical population
b. an independent variable used to express the coordinates of a variable point and functions of them — compare PARAMETRIC EQUATION

2: any of a set of physical properties whose values determine the characteristics or behavior of something <parameters of the atmosphere such as temperature, pressure and density>

3: something represented by a parameter: a characteristic element; broadly: CHARACTERISTIC, ELEMENT, FACTOR <political dissent as a parameter of modern life>

4: LIMIT, BOUNDARY — usually used in plural <the parameters of science fiction>

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Director
Lindsay Lewis

Editor
Toby Weber

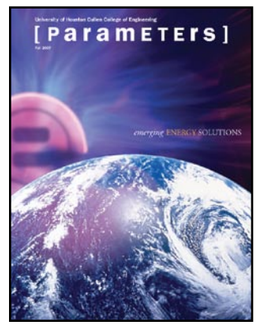
Graphic Designer
Harriet Yim

Contributing Editor
Angie Shortt

Contributing Writers
Krista Kuhl
John Lienhard
Lisa Merkl

Contributing Photographers
John Kish IV
Mark Lacy
Steven Pinchback
Pathik Shah
Jeff Shaw
Thomas Shea
Todd Spoth

Contact us:
Office of Communications
Cullen College of Engineering
University of Houston
E316 Engineering Bldg 2
Houston, Texas 77204-4009
Phone 713.743.4217
Fax 713.743.8240
E-mail parameters@egr.uh.edu
www.egr.uh.edu



Emerging Energy Solutions
As worldwide energy consumption continues to grow, natural resources like oil and gas will become increasingly more expensive to locate and retrieve, resulting in higher prices and a sometimes-inconsistent supply. UH Cullen College of Engineering researchers are developing the technologies that will prolong fossil fuel production and lower its consumption, while developing cleaner and greener technologies that prove to be sustainable.

UH Names

New Engineering Dean

The University of Houston has named Joseph W. Tedesco the sixth dean of the Cullen College of Engineering.

The appointment is effective Jan. 1, 2008.

"I am delighted the Cullen College will benefit from the leadership skills of Joe Tedesco," said Don Foss, UH senior vice president for academic affairs and provost. "He has a wealth of positive experience in both the teaching and the research domains, and has been a highly effective leader of his department at the University of Florida. Consistent with our emphasis on multidisciplinary work, he has been a leader and participant in numerous multi-million dollar consortia. I look forward to working with him in support of the Cullen College of Engineering and the University of Houston."

Tedesco is currently professor and chair of the University of Florida's Department of Civil and Coastal Engineering, which boasts 42 tenure-track faculty members, more than 650 undergraduate students and 210 full-time graduate students. As chairman, he has led the department to a period of great success: annual research expenditures have increased by more than 80% under his watch, totaling more than $18.3 million during the 2005–2006 academic year. He has also shepherded the department's undergraduate program to a national top-ten ranking among public institutions and its graduate program to the number 16 spot nationally.

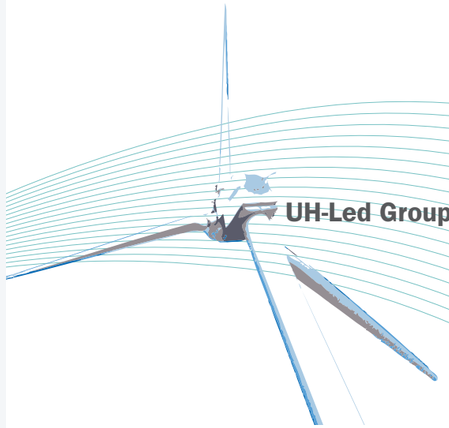
Tedesco has also proved to be a successful fundraiser at the University of Florida. He has raised more than $3.5 million for faculty endowments and more than $4 million for facility improvements, including the construction of a new, 8,500-squre-foot research laboratory.

"I am extremely proud and honored to have been selected as the sixth dean of the Cullen College of Engineering," said Tedesco. "I am tremendously impressed by the number of high-quality faculty in the Cullen College, and am excited by the prospect of collaborating with the faculty to develop emerging research opportunities and strengthen existing academic and research areas of excellence. I look forward to the opportunity to enhance the national recognition and prestige of the Cullen College, as well as foster educational and research alliances with the greater-Houston community."

As a researcher, Tedesco has conducted dozens of investigations into the dynamic response of structures and materials to high-intensity, short-duration impulse loadings. He is currently the technical director representing the University of Florida in a consortium of six universities that were recently awarded a $51 million grant from the Defense Threat Reduction Agency. He also leads a multi-university consortium proposal for a National Science Foundation Engineering Research Center.

Tedesco earned his B.S. from the University of Notre Dame in 1971, M.S. from Tufts University in 1974 and Ph.D. from Lehigh University in 1982, all in civil engineering. In addition to his time at Florida, Tedesco has held professorships at Oregon State University and Auburn University. He is a Registered Professional Engineer in the states of Florida and Alabama and is the author of the internationally renowned textbook *Structural Dynamics: Theory and Applications*. He is a six-time U.S. Air Force Research Fellow and has worked in residence at several Air Force Research Laboratories, including Tyndall AFB and Eglin AFB.

Professor Fritz Claydon's appointment as interim dean of the Cullen College of Engineering has been extended to run through the end of the calendar year, Foss said. "I appreciate his willingness to serve his colleagues and the university in this way," he added.



UH-Led Group Wins

Wind Power Facility

A group led by the University of Houston Cullen College of Engineering has won a major award from the U.S. Department of Energy (DOE) to create one of the world's only facilities for testing large-scale wind turbines. This award anchors the college and the state as leaders in wind power research and production.

The facility will be created through a partnership between the DOE's National Renewable Energy Laboratory and the UH-led Lone Star Wind Alliance. As part of the partnership agreement, the alliance will receive up to $2 million for the facility from the DOE, as will a group from Massachusetts. The Texas and Massachusetts coalitions were selected out of a pool of six candidates that included groups from Iowa, Maine, Ohio and Virginia.

The Cullen College was the driving force in assembling the coalition after the DOE announced it was seeking partners to create the facility in 2006. This May, Raymond Flumerfelt, former dean and professor of chemical engineering, and Su Su Wang, Distinguished University Professor of Mechanical Engineering, wrote the final proposal that ended up winning the facility for the alliance.

"We are very excited about this opportunity," said Flumerfelt. "It's an important step for Texas in the future of renewable energy."

The Lone Star Wind Alliance's facility will be built on a plot of land donated by BP in Ingleside, Texas, just north of Corpus Christi. Operations of the $24 million facility should be fully funded by private wind turbine and blade manufacturers within five years of its construction.

The testing center will be capable of testing blades measuring up to 100 meters long. With such capacity, the facility will be able to conduct tests of blades designed for onshore use, as well as for the largest offshore turbine blades.

This facility could also attract blade manufacturers to Texas in the coming years, thereby acting as an economic growth engine for the state, noted Flumerfelt. "With this facility, we should be able to draw blade manufacturers to the region. That's already starting to happen. We've already been contacted by manufacturers about building the blades here."

A number of groups were vital to the success of the Lone Star Wind Alliance's proposal. The Texas Legislature pledged $5 million toward the construction of the facility. Texas' congressional delegation also strongly backed the effort, with Sen. Kay Bailey Hutchison championing the effort.

The membership of the Lone Star Wind Alliance includes: the University of Houston; Texas General Land Office; Texas Workforce Commission; Texas State Energy Conservation Office; Texas A&M University; Texas Tech University; the University of Texas at Austin; West Texas A&M University; Montana State University; Stanford University; New Mexico State University; Old Dominion University; Houston Advanced Research Center; BP; Dow; Huntsman; and Shell Wind.

RENDERING PROVIDED BY PageSoutherlandPage

The Texas National Large Wind Turbine Research and Test Center will be located in Ingleside, Texas, off the Bay of Corpus Christi.

Cullen College Security Center Improving Safety in the Houston Area

SWTC
SOUTHWEST PUBLIC SAFETY
TECHNOLOGY CENTER

The University of Houston Southwest Public Safety Technology Center was founded in 2005 with a mission of improving the region's security by fulfilling the various needs of municipalities and the first-responder workforce in the State of Texas. Over the past several months, two of the center's most notable efforts have involved the Houston Ship Channel.

PHOTO BY MARK LACY

Steven Pei, executive director of the college's Southwest Public Safety Technology Center and professor of electrical engineering, and Pat Bellamy, director of the SWTC Test and Evaluation Division and chair of the Houston Ship Channel Security Council, catch up with the Port of Houston Authority's chair, James Edmonds, and government relations manager, Scott Forbes, at the Port of Houston Appreciation Lunch on June 13. The Southwest Public Safety Technology Center will be involved in the development of various security systems that will be deployed along the Houston Ship Channel to protect ships and businesses along the water.

As part of its ongoing relationship with Harris County, SWTC has agreed to provide engineering requirements for the development of various security systems that the county intends to deploy along the Houston Ship Channel to thwart attacks on land and from the water. The center will outline the engineering requirements needed for the county to implement video surveillance systems, radar systems and equipment for a central command center along the channel. Harris County has awarded SWTC a $216,000 grant to support these efforts.

The second and more significant success came in June when Texas Governor Rick Perry signed legislation championed by SWTC that enables the creation of the Houston Ship Channel Security District, a groundbreaking public/private partnership to improve security along the Houston Ship Channel.

If formed, the district's board would decide how to best provide security along the Houston Ship Channel and would distribute money collected from businesses within the district accordingly.

The idea for the district was first put forth by the Houston Ship Channel Security Council (formerly the Port Strategic Security Council), a group convened by Harris County and chaired by Pat Bellamy, director of the SWTC's Test & Evaluation Division. SWTC also served as a neutral platform within which stakeholders of the ship channel met to discuss the district's creation and formation. Playing the role of a neutral party helped pave the way for an agreement supported not only by local municipalities but also by the very businesses that the district will collect fees from.

The U.S. Department of Homeland Security looks upon the public/private security partnership enabled by this legislation as a potential model for other ports and ship channels around the country, added Steven Pei, executive director of the SWTC and professor of electrical engineering. Homeland Security has supplied funds for major equipment purchases with the expectation that state and local governments and local industry will be responsible for supporting the ongoing operation and maintenance of this equipment. Should the district be formed, it will likely coordinate the upkeep of boats, vehicles and equipment that Harris County expects to purchase with recent Homeland Security grants.

"The Southwest Public Safety Technology Center did what it always does in these efforts: it enabled collaboration by creating a 'can do' mindset along with an environment where issues were discussed openly and resolved appropriately," said Bellamy. "To me, enabling this type of collaboration, planning and guidance is the greatest contribution and leadership that a university can provide."

College Explores International Partnerships

The UH Cullen College of Engineering is exploring and, in fact, has formed partnerships with educational institutions around the world in order to advance its educational and research endeavors.

In March, the university signed a memorandum of agreement with East China State University of Science and Technology (ECUST). The agreement calls for UH to pursue joint research and educational programs with ECUST in engineering fields. As a result, graduate students from the institution have enrolled at UH this fall.

In January, a delegation from Jamaica made a visit to Houston to discuss the college's energy initiatives and to explore the possibility of developing a partnership. The Jamaican Minister of Industry, Technology, Energy and Commerce, the Honorable Phillip Paulwell, led the group comprised of several individuals from Petroleum Corporation of Jamaica, Petrojam Limited, and the University of West Indies at Mona, Jamaica. The delegation is interested in partnering with American institutions that, like the University of Houston, have strong energy programs and research in the areas of petroleum engineering, wind energy and biofuels.

Last fall, a contingent from UH journeyed to India to discuss cooperative educational programs with five universities throughout the country. These partnerships could involve a split program, with students completing three years at their home universities and then one to two years overseas. The group was led by Larry Witte, the Cullen College's associate dean of graduate studies, and included Haluk Ogmen, chair of electrical and computer engineering; Hamid Parsaei, chair of industrial engineering; and Haider Malki, associate dean of research in the UH College of Technology.

PHOTO BY PATHIK SHAH

Department Changes Name to Reflect Changing Direction

The Department of Chemical Engineering has been renamed the Department of Chemical and Biomolecular Engineering. According to Mike Harold, Dow Chair Professor and department chair, the change reflects the changing direction of the field of chemical engineering.

"We're expanding into different areas, notably biotechnology. Biomolecular engineering is a reflection of one component of biotech where chemical engineers are making an impact," said Harold.

Currently, the department has three faculty members who conduct bio-related research full-time and several others who participate in such research as part of collaborative efforts. A common feature of the bio-related research is the focus on activity at the molecular level.

With the name change the department hopes to attract more graduate students who are interested in this emerging area, and slowly incorporate more biomolecular content into its undergraduate curriculum.

According to Harold, the biological component to chemical engineering isn't new; in fact, chemical and biochemical engineering programs have been around for several decades. However, the biomolecular field is fairly new.

"It really reflects what is happening to our field overall, and that's an increasing focus at the molecular level. Chemical engineers have always studied molecular-level phenomena in order to advance fundamental understanding in the development of new technologies," said Harold. "Students have the advantage of learning biotechnology within the larger subject of chemical engineering. This makes for a powerful combination."

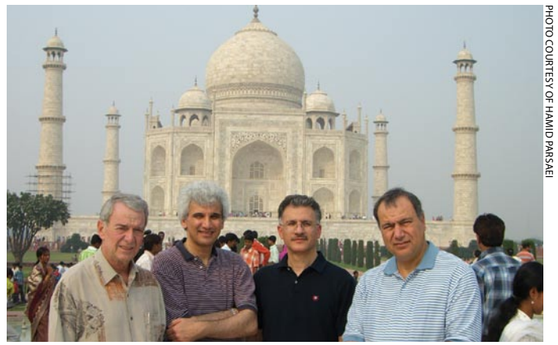


PHOTO COURTESY OF HAMID PARSAEI

(Top) East China University of Science and Technology President Xuhong Qian (pictured third) signs a memorandum of agreement with the University of Houston, paving the way for educational and research partnerships with the Cullen College of Engineering. Electrical and Computer Engineering Professor Steven Pei, Assistant Vice Chancellor for International Studies Jerald Strickland and former UH Chancellor and President Jay Gogue were in attendance for the signing of the agreement.

(Bottom) A delegation from the University of Houston poses in front of the Taj Mahal in Agra, India during a recent trip aimed at establishing academic and research partnerships with several engineering colleges throughout the country. Cullen College of Engineering Associate Dean of Graduate Studies Larry Witte led the group, which included Haluk Ogmen, chair of electrical and computer engineering; Haider Malki, associate dean of research for the UH College of Technology; and Hamid Parsaei, chair of industrial engineering.

EMERGING ENERGY SOLUTIONS

Features by Toby Weber; Faculty Portraits by Jeff Shaw

According to the Energy Information Administration (EIA), the independent statistical and analytical agency within the U.S. Department of Energy, worldwide energy consumption will jump by more than 50% by 2030. EIA data also shows that our current level of energy production is far below this future demand. In order to bridge this gap between present production and future usage we must develop new methods of extracting fossil fuels (the world's primary energy sources), advance technologies that use energy more efficiently, and perfect the alternative and renewable energy sources that one day will be called on to replace non-renewable resources such as oil and natural gas.

Since energy touches practically every aspect of our lives, University of Houston Cullen College of Engineering professors and scientists are developing technologies designed to take us through this spike in demand one year at a time.

UH engineers are developing more efficient methods of extracting oil and natural gas, including huge deposits from reservoirs that have previously been abandoned.

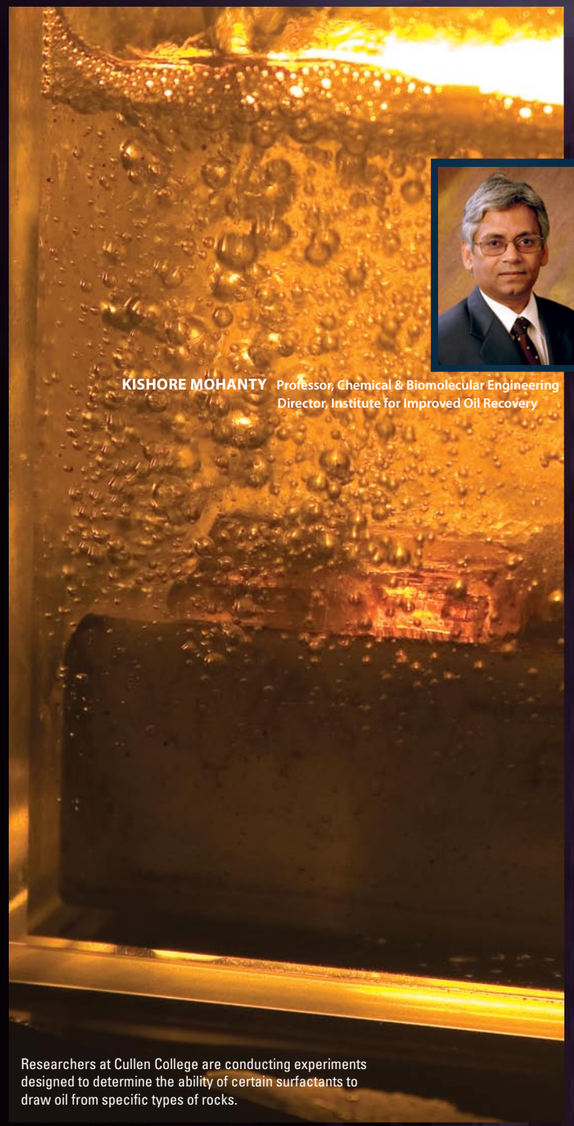
To ease demand and soften the environmental impact of this petroleum use, our faculty are developing and testing technologies that can supplement oil supply, reduce usage and cut emissions from gasoline- and diesel-powered engines.

And to help usher in an era powered by renewable and alternative energy sources, we are developing the technologies that can move these emerging solutions from the laboratory to the real world.

The features that follow do not constitute an exhaustive list of our energy efforts. Instead, they are a selection of high-impact projects that demonstrate the significance and scope of the energy work being carried out here. Through the efforts of researchers at the Cullen College and around the globe, we will save our world from an energy crisis. ▸▸

RECOVERABLE RESOURCES

Fossil fuels will remain the world's biggest energy source for years to come. However, there are many challenges associated with their discovery, retrieval and cost of production. UH Cullen College of Engineering researchers are currently working on solutions that address some of our biggest oil and gas concerns.



KISHORE MOHANTY Professor, Chemical & Biomolecular Engineering
Director, Institute for Improved Oil Recovery

Researchers at Cullen College are conducting experiments designed to determine the ability of certain surfactants to draw oil from specific types of rocks.

PHOTO BY STEVEN PINCHBACK

HOW MUCH OIL IS STILL LEFT IN THE GROUND?

The idea of buried treasure captures the imagination—riches that have been lost and all-but forgotten, just sitting there for the taking by those clever and industrious enough to find it.

Billions of dollars of buried treasure is really out there. Instead of gold, it is in the form of oil. And instead of being forgotten, everyone knows exactly where it is. According to Kishore Mohanty, professor of chemical and biomolecular engineering and director of the UH Institute for Improved Oil Recovery, most reservoirs that have been pumped and abandoned by petroleum companies still have 60% to 70% of their oil remaining in them.

So why isn't this treasure being dug up, so to speak? Simply put, getting it out of the ground has proven too difficult. The properties of reservoirs and of the oil itself make retrieving this oil difficult, time consuming and expensive.

Finding ways to overcome these obstacles is the job of the Institute for Improved Oil Recovery, which is currently focusing on two prominent methods of extracting this oil.

One is carbon dioxide flooding, which entails pumping large quantities of carbon dioxide or similar gasses into the ground. The high-pressure gas mixes with the oil and together they flow out of the reservoir. If the gas pressure is not high enough for the two to mix, the gas simply reduces the oil's viscosity, or thickness, thereby allowing it to flow more easily and be pumped from the ground.

One of the advantages of carbon flooding is its cost. According to Mohanty, this process makes sense financially if oil costs more than about $20 per barrel. There are challenges to the technique, however. These gasses tend to form channels in the oil and escape the reservoir instead of pushing out large amounts of oil. This and other problems are being investigated by the institute.

Surfactants, a class of chemicals similar to detergents, offer another technique for improved oil recovery. When pumped into a reservoir, they bond with both oil and water, allowing oil to flow in the reservoir and up to the surface. Also, in fractured reservoirs, where the rock in the reservoir has long cracks, surfactants stick to rocks' surfaces, detaching the oil that was there previously and allowing it to flow more easily to the well.

One of the advantages of the surfactant method is that it is easy to implement. The method requires only a small amount of chemicals that can be easily transported to any location. There are hurdles to their use, however. In fractured reservoirs, surfactants work slowly, requiring 20 to 30 years to work fully on large reservoirs. In addition, most surfactants will not be wholly effective when a reservoir's characteristics (such as rock composition) change notably from one area to another.

The Institute for Improved Oil Recovery conducts tests and performs mathematical modeling to determine which surfactants are most effective for specific types of reservoirs.

These and other methods, said Mohanty, deserve attention because they can deliver huge amounts of oil with little guesswork. "These processes are promising, and they need to be developed," he said. "We know the oil is there, so there are none of the risks you take with exploration. We just have to improve the recovery technologies. It's all doable."

HOW CAN WE LOWER THE COST OF RETRIEVING OIL?

Lowering the price of oil depends heavily on technological development aimed at making the exploration and production process more efficient. The Well Logging Laboratory at the Cullen College develops such tools in the form of software, sensors and other technologies for recording and interpreting a well's attributes during or after drilling.

RICHARD LIU Professor, Electrical & Computer Engineering
Director, Well Logging Laboratory

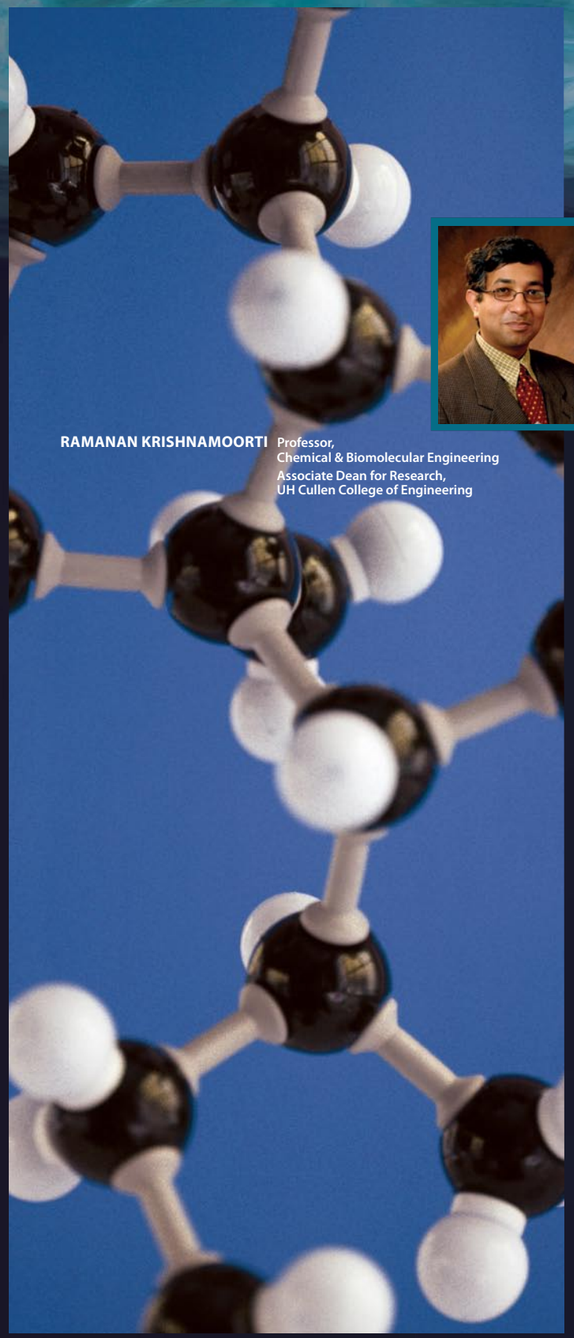
By placing sensors at or near the bit of a drill, or at the end of a wireline, for example, individuals working in the field can receive data that helps them determine how much oil they can access from a particular well, where in the well that oil is located, and what types of rocks they are encountering in the drilling process. Such information allows oilfield workers to make the best, most efficient choices about how to get petroleum from underground to the surface.

There is an obvious economic benefit to making the most efficient drilling decisions, said Richard Liu, professor of electrical and computer engineering and director of the Well Logging Lab.

"Exploration and drilling is a big part of the cost of petroleum. If we can provide the decision-makers at the top of a well with the best information, they can make decisions that will simplify the processes, and that can have an impact on the price of oil," Liu said.

A recent innovation makes this potential clear. The lab has developed a set of microscopic radios that can relay approximately 10-times more information up-hole than traditional systems. By providing more information, those at the top of the well can make better, more-informed drilling decisions. And those decisions could end up saving everyone money at the pump.

PHOTO BY TODD SPOTH



RAMANAN KRISHNAMOORTI Professor,
Chemical & Biomolecular Engineering
Associate Dean for Research,
UH Cullen College of Engineering

HOW CAN WE IMPROVE THE PROCESS OF OIL PRODUCTION?

It's a simple concept: The process of drilling for and retrieving petroleum costs less money if it goes smoothly. If it doesn't, it costs more. Either those savings or those costs eventually get passed on to consumers.

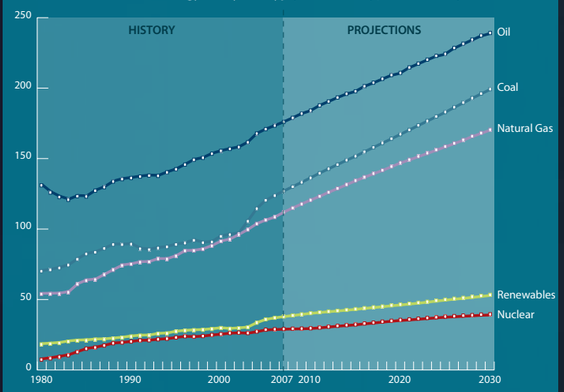
Research conducted by Ramanan Krishnamoorti, professor of chemical and biomolecular engineering, aims to help petroleum and gas production go smoothly through the use of nanotechnology. Many nano-scale materials possess simple yet valuable properties such as high strength, low weight and self-sensing capabilities. Krishnamoorti's research sets the stage for the use of these materials in oilfields and on oil rigs.

A prime example of this involves large O-rings (roughly the size of a typical office), called blow-out protectors, that are used on drills to prevent oil from flowing out. When these rings fail, the drill must be shut down for days while a replacement is ordered and installed.

Krishnamoorti has investigated creating O-rings that are built with carbon nanotubes. These nanotubes can make the rings lighter and stronger. More importantly, rings constructed of these materials will have an essentially stable resistance to electricity until they approach failure. This property would allow individuals in the field to monitor the rings and bring a well to a graceful shutdown when a replacement is needed.

Though nanotechnology's biggest promise lies down the road, right now it can be used to make petroleum production easier and more reliable.

Annual Energy Outlook 2007 with Projections to 2030
World Marketed Energy Use by Fuel Type, 1980–2030 (Quadrillion Btu)



Sources: Energy Information Administration, www.eia.doe.gov

WHAT ROLE WILL PETROLEUM PLAY IN AN ALTERNATIVE ENERGY FUTURE?

Natural gas can be converted into the hydrogen that powers fuel cells, which one day may replace the traditional combustion engine *(for more on fuel cells, see page 16)*.

The technology behind this conversion is well known and well understood. The biggest issues surrounding it are practical and logistical. New methods of supplying fueling stations with this converted hydrogen must be developed. James Richardson, professor of chemical and biomolecular engineering, is developing a small-scale conversion plant that could be installed at individual filling stations.

"The question is where to get the hydrogen for fuel cells," said Richardson. "Do you make it in big plants, which is the cheapest method of production? If you do that, you have to distribute it to filling stations through pipelines or on trucks, both of which turn out to be very expensive. The other alternative is to have a small plant at a filling station that would take natural gas from the existing pipelines and convert it to hydrogen using standard technology."

Designing such a facility, said Richardson, is more complicated than simply shrinking down the large conversion plants currently in operation. To convert natural gas to hydrogen in a small-scale plant, about a third of the gas consumed must be combusted, and the resulting heat transferred to a separate chamber filled with the remaining natural gas and steam, which sets the conversion process in motion.

This transfer of heat is where the challenge lies. While the process is well-established in large-scale plants, it is much more difficult to achieve on the small scale. To make this transfer possible, Richardson is designing a device based on sodium heat pipes, which quickly and efficiently transfer heat though a cycle of vaporizing and then condensing liquid.

Richardson has moved past the design stage of this project and is now in the process of building a miniaturized version of his small-scale conversion plant. Over the next several months, he hopes to establish a relationship with an outside company that would build a working prototype. At that point, real-world evaluations of his creation can begin and comparisons to other solutions, such as the pipeline and delivery truck method, can be made. According to Richardson, cost factors and safety issues, as well as infrastructure needs, will also need to be addressed.

"We'll take a look at the cost, safety issues and infrastructure of these approaches," Richardson said. "We probably won't settle on one, but end up with a combination of several solutions."

JAMES RICHARDSON Professor, Chemical & Biomolecular Engineering

CLEANER CONSUMPTION

Environmental concerns are leading industry and government to invest in technologies that consume less energy and produce cleaner emissions. Researchers at the Cullen College of Engineering are helping to bring these technologies from laboratories to the real world.

PHOTO BY STEVEN PINCHBACK

Mechanical engineering graduate student Brandon Dawson examines an engine used in the department's research efforts in engine controls and optimization.

KAROLOS GRIGORIADIS
Professor, Mechanical Engineering

MATTHEW FRANCHEK
Professor and Chair, Mechanical Engineering

WHAT CAN BE DONE TO REDUCE OIL CONSUMPTION IN AUTOMOBILES?

With gas prices regularly topping $3.00 per gallon around the country, fuel efficiency is getting significant attention from federal agencies and automobile companies. One path to greater fuel efficiency is lean-burn engines, which are internal combustion engines regulated to run on a lower fuel-to-air ratio than standard engines and promise to increase fuel efficiency by up to 20% without sacrificing performance.

Building these engines is one of the targets of the interdisciplinary engine research conducted at the UH Cullen College of Engineering.

This work can be applied to far more than lean-burn engines, noted Matthew Franchek, professor and chair of the college's mechanical engineering department. By providing and unifying mathematical models of engines, exhaust treatment systems and engine diagnostics and control systems, Cullen College enables automobile companies and engine manufacturers to more easily design vehicles with various combinations of power, fuel efficiency and reduced emissions. These efforts at Cullen College are significant enough that they are supported by grants from Ford, General Motors, Cummins Diesel, the Army Research Center and the National Science Foundation.

"This is about systems integration and optimization from a systems engineering point of view," said Franchek. "We're providing these companies the tools to create engines with the characteristics they want."

In the case of lean-burn engines, a large chunk of the effort involves modeling various aspects of lean-burn engines and catalyst systems. Franchek focuses primarily on providing mathematical models of how lean-burn engines should behave under different driving conditions and with slightly different ratios of fuel and oxygen.

Researchers in the Department of Chemical and Biomolecular Engineering model and optimize the design of catalysts for reducing the emissions of lean-burn engines. The catalysts used in standard engines rely on a specific fuel-to-air ratio to effectively reduce nitric oxides, or NOx, a precursor to ozone. Since lean-burn engines operate on a lower ratio, those techniques are less effective at NOx removal. Researchers, therefore, conduct extensive work in NOx reduction that includes catalyst modeling and testing of a separate engine component called a lean NOx trap.

These engine and catalyst models are then applied to engines that are tested under simulated real-world driving conditions. During these tests, there are dozens of different factors that are monitored and regulated to determine the validity of these models.

The data from these tests are then used to create another key component of engines—adaptive controllers for engine regulation and fuel/air ratio control. Mechanical Engineering Professor Karolos Grigoriadis and Franchek are developing complex algorithms that will allow an engine CPU receiving information from various engine sensors to adjust and optimize engine behavior for peak performance and minimal emissions.

Ultimately, Grigoriadis sees these efforts finding their way into commercial use within the next few years. "Engine manufacturers pay attention to even small increases in cost," he said, "but environmental regulations and fuels prices will soon push these technologies into production."

ARE PLANT-BASED FUELS A REALISTIC SOLUTION TO OUR ENERGY DEMANDS?

Ever thought that peanuts, cotton and soybeans could play a key role in the nation's energy independence?

Though it sounds strange, seeds and oils from these plants can be converted into a fuel that is the functional equivalent of traditional diesel. Mike Harold (1985 PhD ChE), professor and chair of the Department of Chemical and Biomolecular Engineering, Adjunct Professor Charles Rooks and their coworkers at the UH Diesel Vehicle Research and Testing Facility are investigating the use of biodiesel as a transportation fuel.

Generally speaking, these biodiesel fuels offer several key advantages over petroleum-based diesel, said Harold. Since they can be produced from domestically grown plants, they are renewable and can also reduce the country's dependence on foreign oil. In addition, all diesel engines can operate on biodiesel fuel without any modifications, making their introduction into the market virtually seamless.

These advantages do not make biodiesel a cure-all. It's unlikely that the United States could ever grow enough crops to completely meet our diesel fuel needs, meaning that biodiesel will only act as a supplement for petroleum-based diesel, not a replacement.

In addition, while they burn more cleanly with respect to particulate and carbon emissions, biodiesels do emit high levels of nitric oxides, or NOx, a precursor to ozone. It's that problem that is being addressed at the Cullen College of Engineering.

"We're trying to find a way to burn biodiesel such that the emissions are actually lower than regular diesel," said Harold. "That requires some synergies between biodiesel and other technologies. Right now, we're working on something that looks very promising."

WHAT IS CURRENTLY BEING DONE TO IMPROVE THE AIR QUALITY IN HOUSTON?

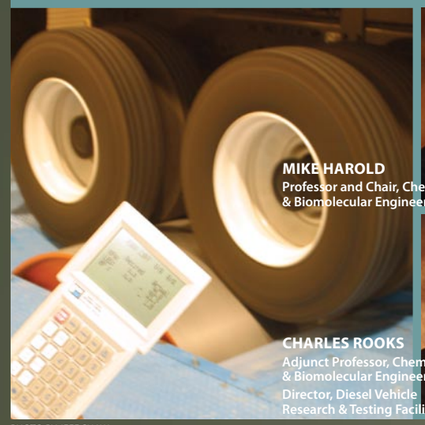
One of Houston's most persistent challenges is its air quality. The city regularly ranks as one of the worst in the country with regards to elevated ozone levels. A respiratory irritant that can cause irreversible lung damage, ozone is formed when nitric oxide gases, or NOx, react with hydrocarbons in the upper atmosphere. Where does NOx come from? Diesel-powered vehicles, in part.

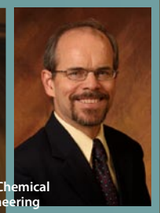
To stop this chain of reactions where it starts, the Cullen College operates the Diesel Vehicle Research and Testing Facility, which serves the City of Houston by testing and optimizing retrofit solutions designed to lower emissions for heavy-duty diesel vehicles like garbage trucks and street repair vehicles. According to Harold, principal investigator of the City of Houston-funded project, many of these tests concentrate on identifying how much, if at all, retrofit solutions for these vehicles reduce NOx emissions.

Among the systems the facility tests are exhaust gas recycling systems, which feed some exhaust back into the engine's air intake, thereby lowering the temperature of combustion and reducing NOx output. Other technologies involve systems that catalytically convert NOx into molecular nitrogen, which comprises about 79% of the earth's atmosphere.

The facility, which is directed by Rooks, passes its test data and recommendations on to the city, which chooses which retrofit systems to install in its vehicles based on performance, cost and other factors.

Though the facility works primarily with Houston, Harold said efforts are underway to establish an official partnership with the State of Texas. Should that partnership be established, its impact will be felt by millions more people across the state.





MIKE HAROLD
Professor and Chair, Chemical & Biomolecular Engineering

CHARLES ROOKS
Adjunct Professor, Chemical & Biomolecular Engineering
Director, Diesel Vehicle Research & Testing Facility

PHOTO BY JEFF SHAW

GOING GREEN

As natural resources, such as oil, gas and coal deplete, energy demands will ultimately have to be met by renewable and alternative energy sources. From well-known sources like wind energy to some ideas you've probably never heard of, Cullen College of Engineering researchers are developing the technologies that will be needed to power the world in the future—some of which are quickly becoming dependable sources of energy today.

Assistant Professor Peter Strasser examines a catalyst material being tested for use in Polymer Electrolyte Membrane Fuel Cells.

PHOTO BY STEVEN PINCHBACK

WHAT MIGHT EVENTUALLY REPLACE OIL AND GAS IN THE FUTURE?

The United States consumes about 9.2 million barrels of oil per day in the form of gasoline. For a number of reasons, this situation isn't sustainable in the long-term. Automobiles will have to change radically, deriving their power from something other than gasoline and diesel fuel. The most promising replacement technology exists, and is being perfected at the UH Cullen College of Engineering, in the form of fuel cells, which utilize chemical reactions to create electricity.

Peter Strasser, assistant professor of chemical and biomolecular engineering, is conducting research into polymer electrolyte membrane fuel cells (PEMFCs). In PEMFCs, hydrogen is split into protons and electrons on a fuel cell's anode side, the section of the cell where chemical reactions begin. The polymer electrolyte membrane in the center of the cell allows the positively charged protons to travel through to its cathode side, where the reactions end.

At the same time, the electrons on the anode side travel through an external circuit to the cell's cathode side, and in doing so create an electrical current that can be used to power automobiles. When these electrons arrive to the cathode side, they bond with the protons that passed through the electrolyte membrane and with atmospheric oxygen to form water, the only "exhaust" produced by PEMFCs.

While a fuel cell's basic reactions are simple enough to explain, perfecting these reactions is where the real work comes in. Strasser is developing catalyst materials that make the reactions on the cathode side—where the chain of reactions end—as efficient as possible.

These catalysts must possess several properties. First, they must instigate the chain of reactions that converts oxygen, protons and electrons to water as quickly as possible. They must also be able to withstand the harsh internal environment of fuel cells, which is highly corrosive due to the acidic nature of the electrolyte membrane. Currently, platinum offers the best combination of these features. Pure platinum alone, however, is not ideal; it is too expensive and, on the molecular level, bonds too strongly with oxygen, which slows the water formation at the surface of the cathode catalyst, making the fuel cell less efficient. Instead, platinum is combined with other cheaper metals, such as cobalt or copper, to form platinum alloys to create the conditions that will yield the most efficient catalytic activity.

"We try to find synthetic methods where we can fine-tune the distance between atoms. In our most recently developed method, we removed some of the non-platinum atoms in the top layer of the catalyst and observed that the remaining platinum atoms stayed in the contracted state that was created when they were alloyed with the other metals. We thereby modified the electronic properties of the surface atoms. That changes the interaction of the surface with the reacting molecules, which modifies the catalytic activity," Strasser said.

With the basic reactions of fuel cells still being perfected, the widespread commercialization of the technology is still years down the road. The efforts undertaken by Strasser and others, however, are key if we are ever to arrive at that future.

WHAT ABOUT WIND?

In terms of the total amount of energy generated in the United States, wind energy's role is negligible. Through technology advancements, though, wind can become a more efficient and economically viable source of energy, moving it from a niche power supply to an important part of the nation's energy portfolio.

The work being conducted by the Cullen College of Engineering's Composites Engineering and Applications Center (CEAC) is designed to affect just that change by providing advanced polymer-based materials that can help wind energy meet its full potential. The center will play a leading role in the new large wind turbine testing facility created in partnership with the U.S. Department of Energy.

Many of the composites developed by the lab for wind energy applications are designed specifically for the blades of wind turbines, thereby addressing some of wind energy's biggest challenges.

The lab, led by Distinguished University Professor of Mechanical Engineering Su Su Wang, is developing composites that posses properties such as high strength, low weight and high resistance to corrosion. Strong materials are needed to prevent the blades from fracturing or failing—a real risk since they are constantly bent and torqued by the wind. At the same time lightweight composites are needed to allow the turbines to be moved easily by the wind. Add to the fact that the blades also must be highly resistant to corrosion since they are constantly exposed to the elements, and the complexity of the materials needed for wind energy applications becomes clear.

Through the work conducted by CEAC, these materials promise to improve—becoming stronger, lighter and more resistant to corrosion—during the coming years.

CAN WE REALLY LEVERAGE THE MOON… FOR ENERGY?

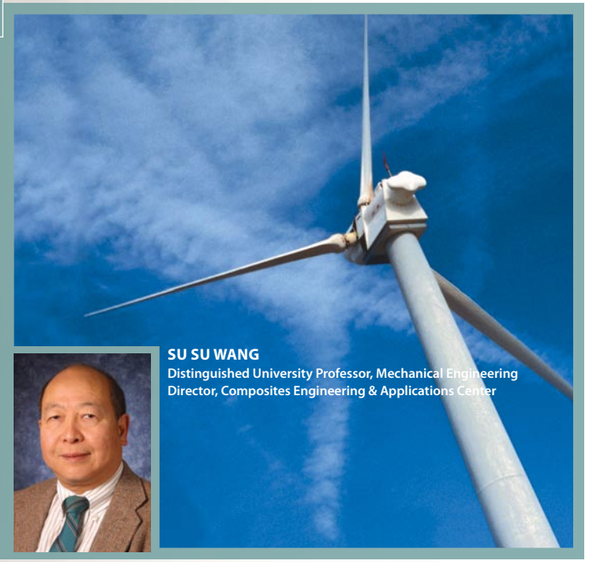
One of the advantages of solar power is that it can be generated anywhere the sun shines—on rooftops, in the middle of a field… and even on the moon.

That last one is not just speculation. Alex Ignatiev, director of the Center for Advanced Materials at UH and Distinguished University Professor of Physics, Chemistry, and Electrical and Computer Engineering, along with his colleague Alexandre Freundlich, research professor of physics, are developing a method—supported by NASA funding—of building solar cells out of lunar dust and rocks.

This would be completed by a lunar crawler—a vehicle in this case about the size of a desk. The crawler would move along the surface of the moon extracting materials such as silicon, iron and magnesium from its surface. It would then melt the lunar surface to form a thin glass layer, evaporate a thin film solar cell directly onto the lunar glass and then connect that cell to the next one it assembles.

In about five years, a single crawler would build enough solar cells to generate enough power for a lunar base supporting about 25 people. Ignatiev envisions more than just power for a lunar base arising from these crawlers, however. The energy generated by these cells could be beamed back to earth to power life down here, he said.

"In the long-term, we've projected that we could build… about one nuclear reactor or one coal-fired plant worth of energy," he said. "So what we're really talking about is producing large amounts of energy, without any contamination."



SU SU WANG
Distinguished University Professor, Mechanical Engineering
Director, Composites Engineering & Applications Center

DECORATED PROFESSOR ADDS UH FARFEL AWARD TO HIS LONG LIST OF HONORS

Fazle Hussain will need a larger trophy room as this year's recipient of the University of Houston's highest faculty honor. Already one of the most decorated scholars in his field, Hussain now can add the 2007 Esther Farfel Award to his list of accomplishments.

By Lisa Merkl

Coming to the United States from Bangladesh as a Fulbright Scholar in 1965 and following graduate study at Stanford University and postdoctoral research at Johns Hopkins University, Hussain joined UH in 1971. He is now the Hugh Roy & Lillie Cranz Cullen Distinguished Professor of Mechanical Engineering. As a fluid dynamicist focusing on the search for 'order within disorder,' he has won the four most coveted awards granted in his field by the American Physical Society, American Society of Mechanical Engineers and American Institute of Aeronautics and Astronautics. He has been elected a fellow of these groups, as well as of the Academy of Sciences for the Developing World and the Bangladesh Academy of Sciences.

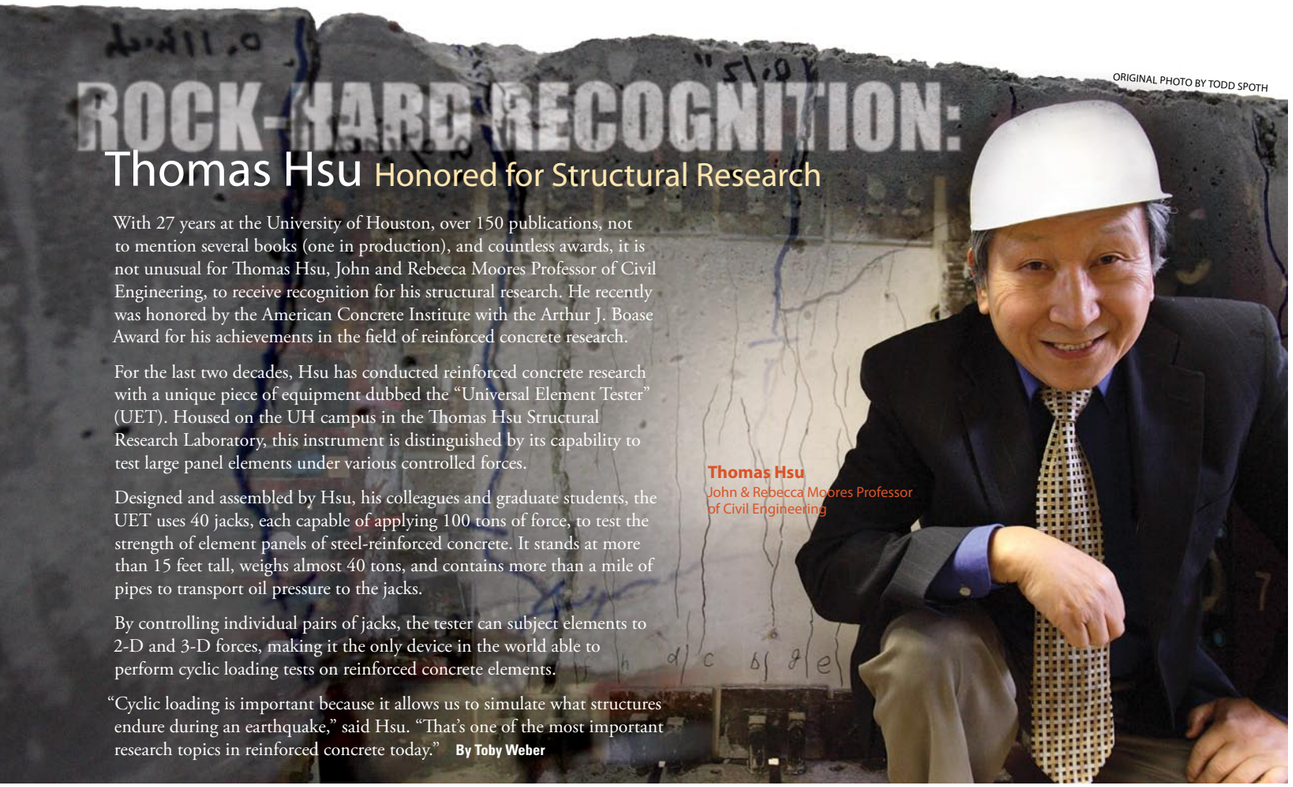
He also has been elected to the National Academy of Engineering and more recently was elected as an officer of its mechanical engineering section, that he will chair starting in 2008, helping to set the section's policy on a range of national issues facing mechanical engineers. This year, he chaired the Engineering Session at the Annual Conference of The Academy of Medicine, Engineering and Science of Texas.

Despite having a full slate of such administrative duties, Hussain remains a productive researcher. In 2006, he received a $300,000 grant from the National Science Foundation to conduct research in the area of abetting wake hazard caused by aircraft. Reducing these disruptive patterns of air movement could cut the separation time between takeoffs and landings on runways—a major problem at busy airports. Leading the Aerodynamics and Turbulence Laboratory at UH, he was one of the first to recognize that the organized motion underlying the seemingly random motion of turbulence is the key to understanding and controlling it for technological benefits.

His other research interests include aircraft drag and reduction, cardiovascular dynamics, cell mechanics, nanomechanics and energy—from which, combined, he has published more than 250 papers, presented 126 keynote and invited lectures in national and international conferences, 395 invited seminars and scientific talks and received more than $15 million in research funding.

Fazle Hussain
Hugh Roy & Lillie Cranz Cullen Distinguished Professor of Mechanical Engineering

PHOTO BY THOMAS SHEA



ORIGINAL PHOTO BY TODD SPOTH

ROCK-HARD RECOGNITION:

Thomas Hsu Honored for Structural Research

With 27 years at the University of Houston, over 150 publications, not to mention several books (one in production), and countless awards, it is not unusual for Thomas Hsu, John and Rebecca Moores Professor of Civil Engineering, to receive recognition for his structural research. He recently was honored by the American Concrete Institute with the Arthur J. Boase Award for his achievements in the field of reinforced concrete research.

For the last two decades, Hsu has conducted reinforced concrete research with a unique piece of equipment dubbed the "Universal Element Tester" (UET). Housed on the UH campus in the Thomas Hsu Structural Research Laboratory, this instrument is distinguished by its capability to test large panel elements under various controlled forces.

Designed and assembled by Hsu, his colleagues and graduate students, the UET uses 40 jacks, each capable of applying 100 tons of force, to test the strength of element panels of steel-reinforced concrete. It stands at more than 15 feet tall, weighs almost 40 tons, and contains more than a mile of pipes to transport oil pressure to the jacks.

By controlling individual pairs of jacks, the tester can subject elements to 2-D and 3-D forces, making it the only device in the world able to perform cyclic loading tests on reinforced concrete elements.

"Cyclic loading is important because it allows us to simulate what structures endure during an earthquake," said Hsu. "That's one of the most important research topics in reinforced concrete today." **By Toby Weber**

Thomas Hsu
John & Rebecca Moores Professor of Civil Engineering

Manolis Doxastakis

Manolis Doxastakis joined the Department of Chemical & Biomolecular Engineering as an assistant professor in January. Prior to this, he served as an assistant researcher in the Center for Nanotechnology at the University of Wisconsin, Madison.

Doxastakis, who earned his Ph.D. in chemical engineering from the University of Patras in Greece in 2001, will research the molecular properties of polymers and biomolecules, revealing the behavior of these molecules under different conditions. The information uncovered from this modeling study will be connected to how the materials behave on the macroscopic level, providing a greater understanding of their properties. In practical terms, this information could be used for medical diagnostics and treatment, or the creation of nanotech-based "smart materials" that automatically perform certain tasks or respond to their environment.

Kyle Strom

Kyle Strom joined the Department of Civil & Environmental Engineering as an assistant professor in January. He received his Ph.D. in civil and environmental engineering from the University of Iowa in 2006. He earned his master's and bachelor's degrees in civil and environmental engineering from Washington State University in 2002 and 2000, respectively.

In his research, Strom will focus on areas such as experimental hydraulics, sediment transport, erosion and environmental fluid mechanics. More specifically, he will study rivers and other bodies of water: how they evolve and transport sediment, how they disperse materials such as contaminants, and how they impact and are impacted by man-made structures such as bridges and dams. These efforts include field studies of rivers and coastlines, as well as computer modeling and physical experiments conducted in a laboratory.

Dong Liu

The Department of Mechanical Engineering has named Dong Liu an assistant professor. Liu earned his Ph.D. in mechanical engineering from Purdue University in 2006 and spent one year as a post-doctoral research associate there before joining the UH Cullen College of Engineering this fall.

One of Liu's research interests is in the field of microscale thermal transport phenomena. This work could be applied to various aspects of energy conversion and thermal management of microelectronics. For instance, Liu's work on single-phase and two-phase transport in microchannels could be used to manage the ultra-high heat flux generated in next-generation computing devices. Liu also studies how to utilize electric fields to manipulate nanoparticles and achieve fluidic actuation and control, research that can be applied to biomedical applications such as drug delivery and lab-on-a-chip systems.

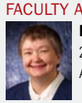
FACULTY AND STAFF ACCOLADES

FACULTY PROMOTIONS

Ji Chen (ECE) and **Paul Ruchhoeft** (ECE) were promoted to associate professor with tenure.

Michael Nikolaou (ChBE), **Hanadi Rifai** (CEE) and **Peter Vekilov** (ChBE) were promoted to full professor.

FACULTY AWARDS



Betty Barr (ECE) received the 2007 UH Provost Faculty Advising Award.

Vemuri Balakotaiah (ChBE) received the 2007 Fluor Daniel Faculty Excellence Award from the college.

Shankar Chellam (CEE), **Gino Lim** (IE), **Y.L. Mo** (CEE), **Michael Nikolaou** (ChBE), **Leang-San Shieh** (ECE), and **Jeffery Williams** (ECE) received 2007 Outstanding Teaching Awards from the college.

Charles Dalton (ME) received the 2007 Career Teaching Award from the college.

Vince Donnelly (ChBE) received the 2007 Senior Faculty Research Award from the college.

Fazle Hussain (ME) was elected as an officer of the National Academy of Engineering's Mechanical Engineering Section. His three-year term includes one-year terms as secretary and then vice-chair and will culminate with him serving as chair. He also received the prestigious UH Farfel Award *(see page 18)*. In addition, he moderated the engineering session at the 2007 Annual Meeting of The Academy of Medicine, Engineering and Sciences of Texas, and served on its organizing committee. He has also been appointed by the National Research Council to serve on the committee to conduct an independent assessment of the nation's wake turbulence research and development program.

Stanley Kleis (ME) received the 2007 W.T. Kittinger Teaching Excellence Award from the college.

Ramanan Krishnamoorti (ChBE) received the 2006 Polymer Physics Prize from the *Journal of Polymer Science*.

Maher Lahmar (IE) and Saif Benjaafar, professor of industrial engineering at the University of Minnesota, won an Outstanding Material Handling & Logistics Research Paper Award from the Material Handling Institute. The paper titled "Design of Distributed Layouts," which describes a novel configuration for factory design, was also featured by *IIE Magazine*, the monthly magazine of the Institute of Industrial Engineers.

Karill Larin (ME) received a Young Investigator Award from the Coulter Foundation. He also was selected to participate in the Office of Naval Research's Young Investigator Program.

Gino Lim (IE) received the Moving Spirit Award from the Institute for Operations Research and Management Science.

Dmitri Litvinov (ECE) was invited to serve as an associate editor of *IEEE Transactions on Nanotechnology* and join the editorial board of *Open Applied Physics Journal*. He was selected to serve on the program committee for the IEEE Nano 2007 Conference held in China and the Perpendicular Magnetic Recording Conference scheduled for this October in Japan. He was also invited to participate as a member of the high profile Special Emphasis Panel to review the applications in response to "Environmental Sensors for Personal Exposure Assessment." In addition, he received the 2007 Junior Faculty Research Award from the college.

Richard Liu (ECE) was selected by the National Academy of Science to serve on the committee on radiation source use and replacement.

Stuart Long (ECE) was appointed by UH as the university-wide associate dean of undergraduate research and of The Honors College. He also was elected to the Board of Directors for the Institute of Electrical and Electronics Engineers, Region IV, and received the Outstanding Service Award from the IEEE Antennas & Propagation Society.

Kishore Mohanty (ChBE) received the 2007 Distinguished Member Award from the Society of Petroleum Engineers.

Hamid Parsaei (IE) received the UPS Award for Minority Advancement from the Institute of Industrial Engineers.

Gerhard Paskusz (ECE), Professor Emeritus, received the 2007 DuPont Minorities in Engineering Award from the American Society for Engineering Education.

Raymond Piper (CEE) received the 2007 Outstanding Lecturer Award from the college.

Jerry Rogers (CEE) has been named a Life Member of the American Society of Civil Engineers.

Pradeep Sharma (ME) received the UH Excellence in Research and Scholarship Award at the assistant professor level. He was recognized for his pioneering nanotechnology research and new nanomechanics education curriculum.

Ravi Singhania (ChBE), adjunct professor, was elected as a commissioner (position 3) for the Port of Freeport. His campaign was titled "Leadership for Responsible Growth."

Julie Trenor, director of undergraduate recruitment and retention and instructional assistant professor, received one of four American Society for Engineering Education's Research & Methods Apprentice Faculty Grants given out nationally to engineering educators. She also was appointed to serve on the Woman in Engineering Programs & Advocates Network's Board of Directors as director of communications for a two-year term. She recently participated in the third annual "Global Marathon For, By and About Women in Engineering," an online forum designed to provide insight and information into the field of engineering.

Peter Vekilov (ChBE) received the UH Excellence in Research and Scholarship Award at the associate professor level. He pioneered research with implications to identify ways to mitigate the harmful effects of debilitating diseases.

Lewis Wheeler (ME) received the Applied Mechanics Division Award from the American Society of Mechanical Engineers.

David Zimmerman (ME) was invited to participate in defining the research roadmap for Damage Prognosis for Nonlinear Structures by Los Alamos National Laboratory.

STAFF AWARDS

Dorothy Barrera, business administrator for the college, received the 2006 Staff Excellence Award from the university.

William "Toby" Weber, senior writer/editor in Engineering Communications, received three awards from the Council for Advancement and Support of Education (CASE) District IV in 2006. He received the Grand Award (Gold) and the Achievement Award (Bronze) in the medical/science news-writing category. He also received the Award of Excellence (Silver) for medical/science feature writing.

KEY

BioE — *Biomedical Engineering*
ChBE — *Chemical & Biomolecular Engineering*
CEE — *Civil & Environmental Engineering*
ECE — *Electrical & Computer Engineering*
IE — *Industrial Engineering*
ME — *Mechanical Engineering*

MAKING AN *Impact*

Cullen College of Engineering's fifth dean reflects on his tenure as he steps down

After leading the University of Houston Cullen College of Engineering through a time of growth and transformation over the last nine years, **Raymond Flumerfelt** has stepped down as dean. He has spent most of his 40-year career in higher education serving the Cullen College—first as a professor of chemical engineering and most recently as dean, where he was able to set forth his vision to transform the college's academic, research and outreach programs. He now returns to his professorship, launching a new chapter in his life and that of the college. **By Lindsay Lewis**

RAYMOND FLUMERFELT

When Raymond Flumerfelt stepped back onto the UH campus in 1998 as dean of the Cullen College of Engineering, he accepted the many challenges associated with an urban university in a state with some of the top institutions in the country.

"The University of Houston has always had an interest in becoming a leading top-tier research institution," he said. "I was excited about the challenge of coming here and advancing that goal."

Flumerfelt was no stranger to nationally recognized programs. Before being appointed dean of engineering, he was a faculty member in the UH Department of Chemical Engineering, from 1968 to 1985, during its rise to a Top 10 program nationally. In fact, in his last two years at UH he served as the department's associate chair, and it was during this time he began to pursue engineering administration.

"I never wanted to be in administration, to go to the dark side," Flumerfelt laughed. "But, as my career developed I started to drift in that direction."

After serving 17 years at UH, Flumerfelt became department chair at the University of Tulsa and, over the next decade, served in several administrative positions, including chair of the Department of Chemical Engineering and deputy vice chancellor of engineering at Texas A&M University, and dean of engineering at the University of Alabama. Two years following his move to Alabama, Flumerfelt found his way back to UH in 1998 as Cullen College's fifth dean of engineering.

"I realized early on that as a lead administrator, you had a great influence on the direction of an organization, particularly if you were fully engaged with your faculty and staff," he said. "My experience in chemical engineering at UH fostered a desire to move programs forward, hire outstanding people, and enhance excellence. People like Dan Luss, Neal Amundson, Ernest Henley and others at UH had an important influence in this view, something that I carried throughout my career in engineering education and research. So when the opportunity arose for me to return to UH, I was happy to return and take on the challenges of continuing its development as a leading engineering program in the country."

PHOTO BY MARK LACY

Raymond W. Flumerfelt
Dean of Engineering, 1998–2007
Elizabeth D. Rockwell Endowed Chair
UH Professor of Chemical Engineering, 1968–1985, 1998–present

Dean Flumerfelt visits with Dan Luss, professor of chemical engineering, and his wife, Amalia, at his retirement party.

Dean Raymond Flumerfelt and wife Barbara (right) visit with Elizabeth D. Rockwell at the Leadership & Donor Appreciation Dinner in 2002.

Before Flumerfelt returned to UH, the college had experienced major financial challenges, among others, including a decreased faculty and staff roster, and a diminishing student body, partially due to the state's shift in weighted credit hours. In fact, when he had left previously in 1985, the college had well over 100 faculty members; however, that number fell over the next decade below 80.

"We had some challenges," he said, "but I worked with the university administration to not only replace some of the positions lost in the early '90s, but also to improve the stature and quality of the faculty."

Since then, the college has experienced a remarkable shift in its faculty—over one-third of the current faculty were hired during Flumerfelt's tenure. He worked to identify and recruit within nanotech and bio-related areas, among others, to encourage interdisciplinary research partnerships within the college and to improve overall research funding.

"We've been able to attract very bright, young, enthusiastic faculty members and researchers to join our well-established senior faculty," he added. "This has resulted in the development of several key research programs that have attracted significant funding to the college. As we continue to grow in that direction, we'll continue to attract that level of faculty researcher to our college."

Early on he focused on department leadership, installing new department chairs partly from existing senior faculty, but mostly from national searches for key people. "Leadership really happens at the departmental level, and to move the college forward, we needed new people with new ideas in these key positions," he said.

In addition, Flumerfelt began building up the college's staff. He believed a strong programmatic and operational staff was critical to the ultimate success of the college. "People make the organization and create the ideas and programs," he noted.

As he continued to expand the college's faculty and staff, Flumerfelt oversaw the development of key educational initiatives. He was concerned about the quality of the student body and its numbers, and launched several programs and initiatives to attract high-quality students, including the Industrial Scholars Interns Program, the Engineering Leadership and Entrepreneurship Program and a center for technical communications. He also developed a strong foundation for educational outreach programs to more effectively recruit and retain the area's promising students. Summer programs like Girls Reaching and Demonstrating Excellence (GRADE) Camp were launched, which not only function as a recruiting tool in general, but address the shortage of female engineering students nationally. The now extremely successful Engineering Career Center was also launched. Only four years in operation, the career center routinely places participating students in employment positions long before graduation, with most receiving multiple offers.

"These programs helped us improve the quality of the student body and our graduates, and better prepare these graduates for a changing work environment and a global economy," he said. "In many cases our programs were at the leading front of such educational developments, and I was very proud of our faculty and staff who worked to make this possible."

During his tenure as dean, the scope of college academic programs began to shift as well. Flumerfelt was instrumental in developing a new biomedical engineering program and expanding the petroleum engineering program, two disciplines that have gained widespread interest in recent years. Given the college's location in Houston near the Texas Medical Center and in the heart of one of the world's most important industry hubs, he recognized the opportunity these programs would give prospective students, as well as faculty researchers.

In 2005, undergraduate students from the Engineering Leadership and Entrepreneurship Program present Dean Flumerfelt with a signed photograph. Pictured with Dean Flumerfelt are Adnan Khan, Ahmed Megahed, Uzochukwu Opurum, Armando Moncivais, Pamela Williams, Dorota Bernatek and Perry Mason.

Dean Flumerfelt congratulates chemical engineering graduate Ariss Catron at the May 2005 commencement ceremony.

"We needed to capitalize on the unique opportunities afforded to our college because of our location," he said. "We have been able to foster many partnerships with other institutions and industries in the area, giving our students more practical experience and our faculty the ability to collaborate on research."

Flumerfelt has also been a successful liaison to the greater-Houston community and industries throughout the region. He has been intricately involved with regional leaders to work specifically on national energy issues. Several years ago, he was a key principal in the creation of the Texas Energy Center in cooperation with the Fort Bend Economic Development Council. Most recently, he worked in a key leadership role with Su Su Wang, Distinguished University Professor of Mechanical Engineering, in bringing a U.S. Department of Energy-supported national wind turbine testing facility to Texas, a major step in the future of renewable energy development in the state. He also worked with the Greater Houston Partnership in the creation of the Greater Houston Energy Collaborative, serving as the first director of its research and technology committee and was one of two masterminds behind the newly proposed Global Integrated Energy Institute at UH, which will serve as a platform for members of industry, government and academia to identify and solve some of the challenges currently facing the energy sector in Houston.

"The world will definitely have major challenges in meeting its energy demands in this century and concurrently addressing related environmental and global warming issues," he said. "We've facilitated community, industry and academic collaboration to work towards developing solutions to the challenges facing our city and our country. If it's not done in Houston, the 'energy capital,' where else will it be done?"

With continued interest in the future of the college, Flumerfelt has been working for the last two years on his vision for a new engineering complex and will continue these efforts as he transitions from his leadership position. The state-of-the-art facility will include a new student center with improved computing facilities, space for student organizations and expanded student services operations, plus an energy wing, with space allotted for the petroleum engineering program and the developing energy institute.

"This will be one of the most influential projects we've worked on for the future of the college. To attract high-quality students and researchers, we critically need expanded and improved facilities. It's essential if we want to remain competitive as we move forward."

Throughout his career in higher education, Flumerfelt has been recognized by engineering societies and organizations, along with students, faculty and staff colleagues. And, though he has stepped down as dean, he will continue to be recognized for the direction he has moved the college throughout his tenure.

"I'm pleased to be leaving the college in good shape for the next dean," he said. "We've come a long way, and though we still have a long way to go, we're heading in the right direction."

For now, Flumerfelt will be on sabbatical for a year and will return in a leadership capacity as the vice director of the wind energy center and as a professor in the Department of Chemical and Biomolecular Engineering, where he looks forward to returning to the classroom and lab once again.

"My tenure as a faculty member and as dean of the college has been an immensely gratifying and rewarding experience. I still owe a lot to UH, and will continue to work on its behalf," he said.

Dean Flumerfelt is given a Bridgebuilder Award by Vita Como, director of professional development. The award is given annually to individuals who contribute significantly to the college.

"Dean Flumerfelt did an excellent job reaching out to and connecting with industry representatives and alumni," said Bill Fendley, co-founder of Cobb, Findley & Associates. "He created and implemented many successful programs, like the Industrial Scholars Interns Program, which have been invaluable to my firm and to other industrial partners. We are grateful for his contributions as dean."

Loyal engineering alums Odis Cobb (1971 BSCE, 1979 MSCE) and Bill Fendley (1971 BSCE), co-founders of Cobb, Fendley & Associates, a civil engineering firm,continued to support the UH Cullen College of Engineering under the leadership of Dean Flumerfelt by serving as members of the Engineering Leadership Board and by participating as industrial partners for the Industrial Scholars Interns Program.

Engineering Trends

Graduate Student Works on New-Concept Shopping Development

A new trend in communities around the Houston area is the development of town centers that provide a thriving urban environment in their suburban locale, a regional destination for shopping, entertainment, business and culture. University of Houston engineering graduate student Courtney Bird is on the forefront of this new development trend—her work contributed to the design of the new Pearland Town Center.

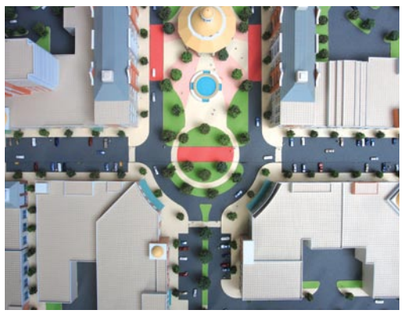
By Krista Kuhl

Bird, who is earning her master's degree in civil engineering from the UH Cullen College of Engineering, conducted work on the project as a member of the land development department with Carter & Burgess, a major engineering, architecture and management consulting firm. Bird has worked for Carter & Burgess since 2003, starting as an engineer-in-training designing wastewater treatment plants, lift stations and public utilities.

"Pearland Town Center is unique, fun and modern. It will bring a lot of interest to the Pearland, Texas area and it will be great for the economics of the community," said Bird. "I worked on the on- and off-site utilities, designed the roads in the surrounding area, and helped with storm drain modification," said Bird.

The development will be adjacent to the Shadow Creek Ranch development off of Texas State Highway 288. It will include apartments, office space, shopping and dining establishments, and a hotel. She is proud to be a part of the design team that developed the site plan. "This project is very unique and I feel privileged to be a part of it so early in my career," said Bird. "It will be well known across Houston and will be a great success."

PHOTOS BY TODD SPOTH



A model of the new Pearland Town Center seen above is located at the Shadow Creek Ranch Visitor Center in Pearland, Texas.

Notably, Bird's involvement in the center is not the only success she has experienced in recent months. She was also named the 2006 Young Engineer of the Year from the Houston-Galveston Post of the Society of American Military Engineers (SAME) for her work with the organization.

The Young Engineer of the Year awards are given out by various engineering organizations as part of the annual National Engineers Week festivities. These awards recognize outstanding young engineers. "I've always been very active with the organization but I was surprised and honored to receive the award," she said.

Bird has been an active member of SAME for over three years and currently serves as post secretary. She is principally responsible for fundraising for the organization's scholarship fund to help high school and college students. She also frequently volunteers for philanthropic events sponsored by SAME and Carter & Burgess.

Bird is taking some time off from her studies this fall to prepare for the upcoming PE exam. She is looking forward to continuing her graduate education in January.

"My graduate studies at the University of Houston are important because they reinforce the technical knowledge required of a professional engineer."

Students Excel at
2007 REGIONAL COMPETITIONS

By Toby Weber and Krista Kuhl

From canoes made of concrete to cars powered by complex chemical reactions, students at the University of Houston Cullen College of Engineering have shined in several recent competitions where they were pitted against teams representing universities from across the state and the region.

"The accomplishments of our engineering students are a testament to their abilities and the education they received at the Cullen College," said Fritz Claydon, interim dean. "We emphasize a 'hands-on' approach that results in our students being very innovative when confronted with complex, open-ended design problems."

1st Place

ASCE CONCRETE CANOE COMPETITION

The best finish posted by UH Cullen College of Engineering students came in the regional concrete canoe competition. The event, hosted by the American Society of Civil Engineers, challenges students to build a canoe constructed of concrete. Over the course of an academic year, the students design, construct and test their canoe, which is made with a concrete mixture that they believe offers them the best combination of low weight and high strength. During the competition, teams are judged based on a design paper, oral presentation on their canoe, various canoe races and the "final product" (including aesthetics and finish).

During the regional competition, Cullen College students challenged eight other teams from Texas and one from Mexico in this annual contest of intellect, art and athletics. By taking first place overall in the region, the team from UH won the right to participate in the national competition in June.

PHOTO COURTESY OF ASCE

2nd Place

CHEM-E CAR COMPETITION

A team of UH chemical engineering students (co-leaders Rhys Forgie, pictured, and Phillip Loya, as well as Rini Abraham, Cuc Nguyen and Preston Harrell) took second place at the Regional Chem-E Car Competition in March, earning them a spot at the national competition this fall.

During the competition, students are asked to develop cars that are powered by different chemical processes. Each university's car is then challenged to travel a certain distance while carrying a specific amount of weight, neither of which are announced until the day of the competition.

The UH team's car was powered with a hydrogen fuel cell that utilized a chemical reaction between manganese dioxide and hydrogen peroxide.

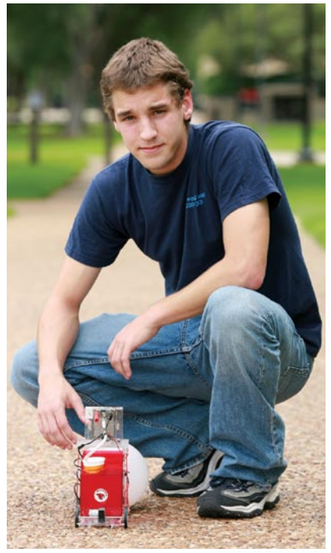


PHOTO BY TODD SPOTH

2nd Place

TEXAS A&M REGIONAL DESIGN COMPETITION

A group of UH freshman engineering students won second place in the Texas A&M Regional Engineering Conference design competition in February, beating out 25 teams from four other universities.

During the competition, engineering students Sheresa Burkey, Crystal Ibarra, Marie Politte and Mauricio Salto were tasked with building a watercraft using a limited set of materials, such as rubber bands and popsicle sticks, that could navigate an obstacle course.

The strong showing by these students follows last year's first-place win at the competition by a freshman team from UH. Both teams had gained prior experience through a project-based introductory engineering course offered by the Cullen College.

Students Launch
NEW ENGINEERING ORGANIZATIONS

Two new engineering student organizations were recently started at UH. The programs, **ENGINEERS WITHOUT BORDERS** and the **SOCIETY FOR PLASTICS ENGINEERS**, hope to bring new ideas and opportunities to students.

Engineers Without Borders (EWB) is a non-profit humanitarian organization established to partner engineers with developing communities worldwide in order to improve their quality of life. This partnership involves the implementation of sustainable engineering projects, that develop and train internationally responsible engineers and engineering students.

The student chapter of EWB at UH was initiated and formed by Christina Dang, a chemical engineering student. "I learned about EWB last year and became interested in bringing a chapter to UH," said Dang. The student chapter traveled to Mexico in August to explore projects involving water distribution and sanitation in three different cities. The group is exploring the creation of an economic development plan specifically for the people of Apasco, Mexico.

Another student organization formed this year was the Society for Plastics Engineers. According to the SPE student chapter president Liang Xu, the society was created to promote science and engineering knowledge related to plastics.

So far, the UH student chapter of SPE has grown to twenty members from various engineering backgrounds. Xu is hoping to recruit more students interested in plastics research.

STUDENT AWARDS

Ashima Bagga (CEE) was awarded second place in the student paper competition for her presentation titled "Chemical Coagulation & Electrocoagulation Pretreatment for Microfiltration" at the Environmental Challenges and Innovations Conference: Gulf Coast 2007.

Courtney Bird (CEE) was recognized by the Houston-Galveston Post of the Society of American Military Engineers (SAME) as the 2006 Young Engineer of the Year.

Alfonso Carmona (ChBE) was named the 2007 Outstanding Junior by the college.

Long Chang (ECE) received a National Science Foundation—Navy Civilian Service Fellowship.

Sandra Geffert (ME) is a recipient of a NASA Harriet G. Jenkins fellowship.

Mohamad Ghosn (BioE) and **Joshua Reese** (IE) received the 2007 Outstanding Teaching Assistant awards from the college.

Austin Head (BioE) was selected to participate in the highly competitive NanoJapan Program. He spent 10 weeks researching nanotechnology in Japan this summer.

Phuc Huynh (ECE) was named the 2007 Outstanding Senior by the college. He also was named a Goldwater Scholar in 2006, one of the most prestigious awards available to undergraduate students in the United States.

Archana Venkataramanan (CEE) received a $5,000 fellowship from the Ivanhoe Foundation for her research on drinking water purification.

Liang Xu (ChBE) took first place in the poster presentation competition at the Frontiers in Materials Research: Applications of Thermal Analysis and Rheology Symposium, held last spring in Dallas and hosted by The Texas and Southwest Thermal Analysis and Rheology Forum.

Lin Xu (ChBE) won the 2006 American Vacuum Society (AVS), Plasma Science and Technology Division's Coburn and Winters Award for the best student paper at the annual International AVS Symposium.

KEY

BioE — *Biomedical Engineering*
ChBE — *Chemical & Biomolecular Engineering*
CEE — *Civil & Environmental Engineering*
ECE — *Electrical & Computer Engineering*
IE — *Industrial Engineering*
ME — *Mechanical Engineering*

PHOTO BY JEFF SHAW

The Agrawals: Durga, Brij and Hari

PHOTO BY MARK LACY

common causes

By Toby Weber

Cullen College Alums **Durga** and **Brij Agrawal**, along with **Hari Agrawal**, trace their success and generosity to their early years in India and the opportunities of the United States.

Whether nature or nurture, it's easy to see common traits among family members—the knack of a natural handyman, a peculiar sense of humor and a talent for music all can be seen across generations of a given family.

Durga D. Agrawal (1969 MSIE, 1974 PhD ME) and his nephews, cousins Brij (1988 BSME) and Hari Agrawal, share the enviable traits of an entrepreneurial spirit, a philanthropic impulse and a true passion for education.

All three came to Houston from India as young men, have formed successful businesses, and have given generously to educational and community organizations in the area and around the world. And all hope that those who receive their help will give in turn.

Initial Impressions

For each Agrawal, the motivation to come to the United States was simple opportunity. While they could have all done well for themselves in India, the rewards available to them in the United States were too great to ignore.

"We grew up in an environment where we worked the same way we do now. We just got rewarded here 1,000-times more," said Hari Agrawal.

The period of adjustment after coming to the United States was different for each. Brij Agrawal came to Houston in 1979 shortly after having graduated from high school, and found the change difficult. Hari, however, was older when he left India in 1980, having already earned a master's degree in microbiology, and found the transition a little easier.

All, however, were taken aback by how accepting the country was to them as foreigners. Durga was especially touched by how welcoming the professors at the University of Houston Cullen College of Engineering were to him when he began his graduate work in the late 1960s.

"When I came over here, the professors probably didn't understand half of what I said, and I didn't understand half of what they said. Still, they did not discriminate," Durga stated. "All these professors did not worry about the color of my skin, they did not worry about my accent. They poured their heart and soul into a foreign student, even in those days, in 1968."

Durga Agrawal (1969 MSIE, 1974 PhD IE)
President, Piping Technology & Products Inc.
Distinguished Engineering Alum (1998)

PHOTO BY THOMAS SHEA

For Durga Agrawal, a fairly straight line can be drawn from his education to his business interests. Shortly after finishing his doctorate in 1974, his entrepreneurial spirit kicked in. Working as a designer of piping and pipe-hanger systems for an engineering and construction company, he was frustrated by the long lead times between designing and ordering a system and actually receiving it from the manufacturer—often around 16 weeks.

"I couldn't understand why it took so long for them to make such a simple product," he said. "I started thinking about designing and making the product myself. That's when I got into this business."

Durga's initial start-up has since grown. Piping Technology & Products Inc. and its wholly owned subsidiaries: U.S. Bellows Inc., Sweco Fab. Inc, Pipe Shields Inc. and Fronek Anchor Darling Enterprises now employ approximately 550 people and count some of the largest companies in the world as clients, including ExxonMobil, Chevron, Bechtel, KBR and Dow Chemical.

Entrepreneurship

Of course, hard work—extremely hard work—defined each Agrawal's early years in the United States. When Hari immigrated, he delivered newspapers from 1 a.m. to 5 a.m., then worked eight-plus hours at his full-time job. Durga earned his M.S. and Ph.D. in industrial engineering at UH while working and raising a family, and Brij was married and worked full-time while earning a degree in mechanical engineering at UH through night classes.

Eventually all three moved from working for others to working for themselves. (Read more about Durga Agrawal's business interests on page 32.)

Brij Agrawal (1988 BSME)
President, VKC I LP dba Subway
Distinguished Engineering Alum (2007)

PHOTO BY MARK LACY

A few years after earning his B.S. in mechanical engineering from UH, Brij Agrawal purchased a company that provided maintenance services to refineries and petrochemical plants. A few years later the firm began manufacturing drilling rig components and equipment for refineries and petrochemical companies. The expansion earned the company a spot on the list of Houston's 100 fastest-growing companies. At the urging of a his older brother, who felt the manufacturing business left Brij little time for anything else in life, he purchased his first Subway sandwich shop franchise in 1998 and sold his manufacturing company a year later. He now owns 49 Subway units in and around Houston, making him the area's largest franchisee and one of the ten largest in the world.

Hari Agrawal, though not an alum of UH, has undoubtedly established himself as a member of the Cullen College of Engineering's community through his family's connection to the college and through his own activities. Like Brij and Durga, Hari worked in various jobs in the area before starting his own firm. He now owns and operates CNA Metals, an exporter of ferrous and non-ferrous scrap metals to the recycling industry worldwide.

Giving Back

Durga, Brij and Hari Agrawal all trace their success back to a few common factors. In India, business acumen is known to run in the Agrawal clan—a group that can trace its roots back 5,000 years to Maharaja Agrasen, a well-known Indian king, and numbers in the millions. For all three, this reputation was borne-out at home, with the parents of each operating their own businesses. It was through these businesses, in fact, that they were taught their earliest lessons about generosity and charity.

For example, every day both Hari's parents and Durga's parents would set aside a percentage of the profits from their businesses for charity.

"My father would explain to me, whatever we are, we are because of the people around us and because of that we should give to those around us," Hari said.

At the University of Houston, this attitude finds its form primarily through the financial support of students. Durga has established an endowed scholarship for the Industrial Engineering Department in the name of Piping Technology & Products, and both Hari and Brij donate to that scholarship fund. In addition, Brij has set up a Presidential Endowed Scholarship at the Cullen College and Hari is a regular contributor to scholarship funds at UH's Bauer College of Business.

Durga, Brij and Hari make active efforts to build relationships with the students who receive these scholarships, forming bonds that last well beyond college.

The Agrawal's philanthropic efforts extend far beyond the Cullen College of Engineering, of course. All three Agrawals donate to a charity in India called One School, One Teacher, which provides funding for teachers in small villages.

Durga is also spearheading the creation of a new community center in Houston. In addition, Brij sits on the board responsible for the expansion of the UH System at Sugar Land campus. Such a project, which makes education more accessible to those living in Houston's southwest suburbs, is a natural fit for Brij.

"When I came here, I had to work to survive," he said. "I would not have graduated from college if it wasn't for UH. That's why I'm so passionate about community colleges and schools that offer programs where people can take classes at night. That's why I'm so attached to the Sugar Land campus."

Like most who give generously of their time and money, all three Agrawals hope these endeavors impact more than just their direct beneficiaries. They hope that the students who receive financial support through their scholarship donations will in turn help support others when their time comes.

"When I was in college, I got a scholarship that paid for everything—tuition, food, everything," said Durga. "I hope these students who get support from us will turn around and help other students five or ten years from now."

PLAYING *THE GAME*

Real-World Impact in the Virtual World

By Krista Kuhl

The video game industry is no game—it's big business. Last year, gaming revenues amounted to over $12.5 billion in the United States alone—a 19 percent jump over 2005, which was the previous highest grossing year in U.S. gaming history.

Needless to say, there is definitely a demand for not only more games, but more interesting games. Like television, gaming is experiencing a shift toward strong, reality-based entertainment and, as technology advances, is capturing and recapturing the interest of new and experienced gamers alike.

Mitch Bunnell's gaming technology, Digital Molecular Matter, is demonstrated in the above frame (taken from Lucas Arts' new Star Wars game) as the bolder realistically shatters into rock fragments. Image provided by Lucas Arts.

For UH Cullen College of Engineering alumnus **Mitch Bunnell** (1985 BSEE), that's good news, any way you play it. Over the past several years, Bunnell's company, Pixelux Entertainment, has developed gaming technology that introduces more of the real-world into animated environments—and is more cost efficient to produce.

To address the problem of skyrocketing video game production costs, along with the constant need to improve the player's experience, Bunnell founded Pixelux in 2003. The company developed new gaming technology called Digital Molecular Matter (DMM) that captured the attention of George Lucas' LucasArts. Pixelux has since signed a multi-year contract with the multimedia giant to incorporate DMM into their next ten games, including Indiana Jones and Star Wars titles, both to be released soon.

DMM provides a material physics simulation for objects in a game's environment. Items such as tables, walls and trees are simulated to behave in accordance with their real-world make-up.

"In the old games you couldn't interact with the environment, such as walls, tables and other inanimate objects," said Bunnell. "You couldn't put a hole in the wall or could maybe break one table because that was pre-animated by artists but another wouldn't. With our technology everything in the video game acts like its real material. All wooden things break like wood and all glass breaks like glass; the entire environment is much more interactive."

This approach cuts game production costs by automating a large portion of the most expensive part of the video game production process, the art asset generation. DMM enables the game environment to respond to a player's actions in real time, instead of having this interaction pre-animated by artists. As a result, thousands of hours of animation time (and the costs associated with that time) can be saved.

LucasArts, the video game division of LucasFilm, contacted Pixelux after seeing early non-real-time animations created by Bunnell's company. Although schedule to debut within two years, LucasArts requested the DMM technology to be complete within four months for possible integration into newly-developed games. Following a demonstration of the technology, a mere four months later, Pixelux received a standing ovation from the Lucas Arts team.

"We expect that in a few years there won't be action games without our technology. Once you play a game where your entire environment interacts with you and is realistic, it's almost impossible to go back," said Bunnell.

::::: 1950's :::::

Robert C. (Bob) Peace (1954 BSCE) is now retired in Williamsburg, VA. He served 10 years with the U.S. Navy before working as chief engineer and managing director of the Jacksonville Port Authority. He was also a vice president at Florida Rock Industries.

::::: 1960's :::::

Raymond G. Bailey (1963 BSChE) has published a new book, "The World is Our Course," based on his golfing adventures at courses around the globe. He also published "The Fall of the American Empire" last spring. Bailey is retired from his previous position as president of Exxon, Arabian Gulf. He can be reached at rgbailey@baileyhouse.com.

Durga D. Agrawal (1969 MSIE, 1974 PhD IE) joined the board of directors of Friedman Industries Incorporated.

::::: 1970's :::::

Manmohan Kalsi (1970 MSME, 1975 PhD ME) received the Woelfel Distinguished Innovation Award from the American Society of Mechanical Engineer's International Petroleum Technology Institute. Kalsi Engineering received the award for its Kalsi Hydrodynamic Thrust Bearing™.

William "Bill" Fendley (1971 BSCE), co-founder of Cobb, Fendley & Associates, was installed as president of the Texas Society of Professional Engineers at the organization's annual meeting in June. He can be reached at bfendley@cobfen.com.

Wayne Klotz (1976 MSCE) was selected as Diplomate of the American Academy of Water Resources Engineers, the highest achievement in water resources engineering. He is also a candidate for president-elect of the American Society of Civil Engineers. He can be reached at wayne.klotz@klotz.com.

::::: 1980's :::::

Terri Ivers (1980 BSME) was appointed president of AMEC Paragon.

Zaki Husain (1982 PhD ME) received the 2007 International School of Hydrocarbon Measurement's Laurence S. Reid Award in recognition of his significant contributions in the field of hydrocarbon measurement and control.

Arup SenGupta (1984 PhD EE) received the 2007 Grainger Challenge Prize Silver Award from the National Academy of Engineering for a community water treatment system employed throughout villages in India to remove arsenic from the water *(see page 36)*. SenGupta and colleagues share the award with the non-profit organization Water For People.

Daniel Wong (1983 BSCE, 1985 MSCE, 1988 PhD CE) has been elected the first vice president of the Texas Municipal League, Region 14.

Mark V. Glorioso (1984 BSEE) was awarded NASA's Exceptional Achievement Medal as chief of the Engineering and Science Directorate's Science and Technology Division at NASA Stennis Space Center.

Ravi Murti (1984 BSIE) is the program manager for International Programs at Lockheed Martin Missiles and Fire Control, located in Dallas.

John Dobitz (1986 MSPE) has been appointed the new senior vice president of engineering and head of CO2 operations for Rancher Energy.

Julian Morales (1986 BSEE) was elected IEEE Galveston Bay Section Chair for 2007 and has been named senior project manager at CapRock Communications.

Paul W. Ullman (1986 BSCE) has joined CLR Inc. as the new GIS manager.

Steve Slawson (1987 BSEE, 1989 MSEE) was named director of International IT Services, Eastern Hemisphere at Occidental Petroleum Corporation. He is responsible for regional digital oil field implementations, production system standardization, telecommunications, infrastructure and technical computing. He and his wife, Connie, and their two children, Sophia and Storm, relocated to Abu Dhabi in Aug. 2006. He can be reached at steve_slawson@oxy.com.

Frank P. Dylla (1988 BSCE) and his wife, Debora, welcomed their fourth child, Catrina Caroline, last summer. She weighed 6 lb., 10 oz. Frank is currently a structural analyst on the F-35 JSF program at Lockheed Martin in Fort Worth.

Ron Ripley (1988 BSME) is now married to Martha Haynes Keller and is a reliability engineer for Praxair Inc.

Christos Angelides (1989 BSME) has been appointed as vice president for URS Corporation and is responsible for coordinating the URS Process and Energy Group's international marketing activities. He will also serve as the marketing liaison, work on the joint development of major programs in the U.S. and continue his current role as general manager.

::::: 1990's :::::

Robert A. Nicol, Jr. (1992 BSME) is bringing industrial techniques, engineering and business management to the Broad Institute's efforts to read and catalogue the data contained in DNA. This knowledge will help researchers decipher the fundamental processes of life and develop medicines to combat cancer and other diseases.

Siddika Demir (1993 BSCE) received the 2006 Emerging Leaders Award from the Society of Women Engineers for demonstrated leadership in quality assurance. She is the manager of corporate services, Six Sigma, for Bechtel Corporation.

Mark Dessens (1993 BSCE) joined CLR Inc. as senior project manager and manager of the Public Works Division.

John "Danny" Olivas (1993 MSME) journeyed to the International Space Station as a member of the STS-117 Atlantis crew in June.

Kurt E. Killian (1995 BSCE) has earned his professional engineer license and has been promoted to project engineer in the Water Resources Division at CivilTech, where he has worked for 10 years.

Yaramy Treviño (1995 BSEE) was honored as the Society of Mexican-American Engineers and Scientists 2007 Young Engineer of the Year.

Nivine K. Zakhari (1996 MIE) received the 2006 Legal Professionalism Award from the American Bar Association. She has also been recognized for her work as the national student liaison this past year and has been appointed vice-chair of the Membership and Equal Opportunity Committee.

Akihiko Hoshide (1997 MSAeroE) was selected as a NASA crew member for Shuttle Mission STS-124.

Alfred Castillo, Jr. (1998 BSCE, 2002 MCE) was promoted to project manager for the Dow Chemical Company's St. Charles Operations in Louisiana. He and his wife, Diana, are also celebrating the birth of their second child, Jaden Andrew Castillo.

Anjali Prasad (1998 BSME) was nominated as director of the Society of Petroleum Engineers Gulf Coast Section for 2007–2008.

Mujahid Muhammad (1999 MSEE) was awarded the second U.S. patent for a novel on-chip Electrostatic Discharge (ESD) protection device. He is currently focused on documenting ESD design guidelines while conducting protection design reviews. He is the author/co-author of 18 technical papers, two patents and five pending patents.

::::: 2000's :::::

Xiuli Wang (2000 PhD ChE) was named a 2007 Asian-American Engineer of the Year by the Chinese Institute of Engineers, USA.

(Continued on page 37)

ENGINEERING ALUMNUS RECOGNIZED FOR

Arsenic Removal Process

Arup SenGupta's research has yielded arsenic-safe water for 200,000 people in India

PHOTO BY JOHN KISH, IV

By Toby Weber

The World Health Organization has called it the worst case of mass poisoning in human history, and now an alumnus of the UH Cullen College of Engineering has been recognized for his efforts to stop it.

Arup K. SenGupta (1984 PhD EnvE), P. C. Rosin Professor of Environmental Engineering at Lehigh University in Bethlehem, Pa., led a team of researchers that took the Silver Award in the Grainger Challenge Prize. The contest, sponsored by the Granger Foundation and the National Academy of Engineering, asked researchers to develop methods to remove arsenic from drinking water taken from wells in eastern India, near its border with Bangladesh.

According to the World Health Organization, arsenic affects as many as 100 million people in the region, leading to cases of skin lesions and cancer, and possibly resulting in death.

"This is probably the biggest natural calamity civilization has ever seen," SenGupta said. "But it is slow, and since it is slow, it doesn't attain the notoriety it should. It's not like a plane crash or a sudden natural disaster where people die instantaneously."

SenGupta's arsenic-removal system was developed a decade ago. All told, a total of about 200,000 people receive arsenic-safe water from the approximately 170 filtration systems he has deployed in eastern India over the last 10 years.

The system utilizes an elegant solution to the problem of arsenic contamination by using one impurity in the water to remove another.

In the system, a hand pump brings water from a well through piping to the top of a cylindrical chamber. The water enters the chamber in a spray of tiny droplets, exposing them to atmospheric oxygen, thereby causing iron in the water to oxidize and precipitate out. The iron oxide then absorbs much of the arsenic. Additional arsenic is absorbed by activated alumina granules that fill much of the column. These two processes together lower the arsenic content of water to less than 20 parts per billion—in line with the World Health Organization's safety standard.

Removal of arsenic is just one part of the challenge to providing arsenic-safe water to the people of this area. SenGupta's system is also designed to easily address the issues of upkeep and arsenic storage. When the ability of the activated alumina in a column is spent and the arsenic captured in a unit needs to be removed, both are sent to a central processing facility. There, the alumina is regenerated and the arsenic is stored in a coarse sand pit, where its bond with iron oxide and exposure to oxygen prevent any significant amount of arsenic from leaching back into ground water.

While the system itself is donated to villages, in order to receive one, members of a village must meet and agree to pay for its upkeep—usually around 30 to 40 cents per family per month. The money collected from villages funds the operation of the central processing and storage facility, where members of communities that have arsenic-removal units find part-time employment.

The fact that SenGupta's efforts are so grounded in real challenges and solutions is not surprising. He was employed for several years as a professional engineer working in the field before pursuing his Ph.D. degree, though he only planned on earning an M.S. when he came to the Cullen College. It was here, however, that he chose to make research and academics the foundation of his professional life.

"Originally, I didn't plan to get a Ph.D. I didn't have a good opinion of what goes on in an academic institution," he said. "I'm thankful [to the Cullen College] in so many ways. They funded my studies. It was the place that changed me altogether, where I realized that I wanted to be in academia."

That investment the college made in SenGupta more than two decades ago, and the change of heart he had while here, has yielded immense returns—now hundreds of thousands of people in India are drinking arsenic-safe water.

(Continued from page 35)

Peter A. Ring (2001 BSCE) is manager of the Transportation Engineering Division at CLR Inc.

Kenneth Flakes (2002 BSME) was named 2007 Young Engineer of the Year by the National Society of Black Engineers—Houston Alumni Extension.

Colby W. Wright (2002 BSCE) was licensed as a Professional Traffic Operations Engineer and is a project manager at Traffic Engineers Inc.

Masood Anjom (2003 BSEE) has graduated law school and is working as an associate at Baker Botts L.L.P.

Reynaldo Guerra (2003 BSME) completed a master's degree in mechanical engineering from the University of California, Berkeley in 2006. He is now pursuing doctoral studies and is supported by a National Science Foundation Fellowship.

Phil Kurtz (2003 BSIE) was recognized as the Puritan Services Inc. Account Manager of the Year for 2005. He has been with Puritan for 19 years and is responsible for market development and sales for the Texas and Louisiana Gulf Coast area.

Joseph Scarborough (2004 BSCE, 2006 MCE) married Ana Fallas, a UH political science graduate.

SEND US

your alumni news about new jobs, promotions, honors, moves, marriages, births, etc. Attach additional news clips or photos separately. Please include a self-addressed stamped envelope if you want your photos returned.

All Class Notes should be sent to:
Parameters Magazine, UH Cullen College of Engineering
E316 Engineering Bldg 2, Houston, TX 77204-4009

E-mail **parameters@egr.uh.edu** or use the online form at **www.egr.uh.edu/parameters**

Name _____

Degree(s)/Major(s) _____ Class Year(s) _____

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News _____

::::: DEATHS :::::

Richard P. "Dick" Doss (1948 BSCE) passed away March 16, 2007. Doss served in the Army Air Corps during World War II. He worked as a Harris County engineer for 25 years and oversaw the construction of the Astrodome.

Forest W. Goodrum (1949 BSArchE) passed away Sept. 26, 2006. He served in the Army Signal Corps in Europe during World War II. He worked as a civil engineer for 45 years first with the Texas Highway Department and later with Metro.

Morris Halpin (1949 BSArchE) passed away Jan. 16, 2007. He served in World War II. Among his many career projects, he wrote the specifications for the site development and the buildings at the Johnson Space Center.

Joe P. Jamison (1949 BSEE) passed away Oct. 17, 2006. He proudly served his country in the U.S. Air Force 8th squadron's B.A.D. radio group stationed in Wharton, England during World War II. After graduating from UH, he began his career as a professional electrical engineer. He and his wife founded the Scottish Pipers, Drummers and Dancers Association.

Lloyd Roland Graves (1952 BSEE) passed away in May 2007. He served in the U.S. Navy during the 1940s before returning to school. In 1973, he opened Lloyd Graves Electric. He once served as president of the National Shrine Directors Association.

Michael Seale Haltom (1971 BSCE) passed away Oct. 17, 2006. He was a civil engineer and worked for Insultherm for 18 years. He enjoyed carpentry, canoeing and spending time with his family.

Paul Joseph Koszela (1984 MSCE) passed away Jan. 16, 2007 after a long and courageous battle with cancer. He was one of the key leaders of Paragon Engineering Services.

Andrew Buoy (1994 BSChE) passed away Aug. 8, 2006, at the age of 38.

Belgacem Baghdadi (1995 BSChE) passed away March 23, 2007. He graduated Magna Cum Laude from UH. He worked in the field of fluid flow simulation software and traveled extensively to France, the UK and China.

KEY

AeroE	— *Aerospace Engineering*	EE	— *Electrical Engineering*
ArchE	— *Architectural Engineering*	EnvE	— *Environmental Engineering*
BioE	— *Biomedical Engineering*	IE	— *Industrial Engineering*
ChE	— *Chemical Engineering*	ME	— *Mechanical Engineering*
CE	— *Civil Engineering*	MatE	— *Materials Engineering*
ComE	— *Computer Engineering*	PE	— *Petroleum Engineering*
E	— *Engineering*		

PHOTO BY TODD SPOTH

Energy efficiency and consumption

The Engines of Our Ingenuity, Episode 984 • By Dr. John Lienhard

Dr. Lienhard reads the record of history and finds that energy efficiency, without conservation, can spell trouble.

Economists Herbert Inhaber and Harry Saunders take a disturbing look at energy conservation.

They begin in 1845. An English mathematician, William Stanley Jevons, had just written a book titled The Coal Question. Watt's new engines were eating up English coal. Once it was gone, England was in trouble. And Jevons wrote:

… some day our coal seams [may] be found emptied to the bottom, and swept clean like a coal-cellar. Our fires and furnaces… suddenly extinguished, and cold and darkness… left to reign over a depopulated country.

The answer seemed to lie in creating more efficient steam engines. Jevons may not have realized that steam engines were already closing in on thermodynamic limits of efficiency. But he did see that increased efficiency wouldn't save us in any case.

Look at the Watt engine, he said. It was invented because the older Newcomen engine was so inefficient. Did Watt cut coal consumption by quadrupling efficiency? Quite the contrary. By making steam power more efficient, he spread the use of steam throughout the land. Coal consumption was skyrocketing.

A few years later, Henry Bessemer invented a new highly energy-efficient scheme for smelting steel. Jevons' argument played out once more. Now that we could have cheap steel, we began making everything from it—plows, toys, even store fronts. Energy-efficiency had again driven coal consumption upward.

We saw Jevons' script replaying yet again after the Arab oil embargo in the 1970s. Our response was to create more energy-efficient cars. Since then, Americans have increased the number of miles they've driven to 162 percent of what it was.

Right on the heels of Jevons, Karl Marx went back to the efficiency argument. Marx believed that production would become so efficient as to eliminate most work. Few failures of Marxist theory were as dramatic as this one. Industrialization freed us all right. It freed us to find other things to work at.

At the very beginning of the 19th century, William Blake wrote, "Energy is pure delight." It may appear that our ecology and our survival are doomed as we ride the delightful downward roller coaster of energy production and consumption.

Still, Inhaber and Saunders offer hope. Sure, they trash any hope of creating a decent world with laissez-faire mechanisms. But they also remind us that we will conserve energy when we, as individuals, want to conserve energy. We'll conserve energy when we choose to turn off the lights as we leave the room—when we choose to recycle bottles and ride the bus. It is you and I who'll save ourselves. It's never been anyone else—not our government, not the collective. You and I will save the world—but only when we realize how badly we want to save it.

The Engines of Our Ingenuity is a nationally-recognized NPR radio program authored and voiced by John Lienhard, M.D. Anderson Professor Emeritus of Mechanical Engineering and History at the University of Houston. After 20 years on the air, over 2,250 episodes have run. The program airs Monday thru Friday on KUHF-FM 88.7 at 7:35 a.m. and 3:55 p.m. For more information about the program, visit www.uh.edu/engines.

Inhaber, H., and Saunders, H., Road to Nowhere. *The Sciences*, Vol. 34, No. 6, November/December 1994, pp. 20–25.

Texas Senator Kay Bailey Hutchison held a press conference in March at the UH Cullen College of Engineering to announce new renewable energy legislation and to commend a UH-led effort to bring the U.S. Department of Energy's large wind turbine testing facility to the Texas Coast. In June, DOE granted Texas the opportunity to design, construct and operate one of two national wind research and testing facilities. Learn more about the effort on page 5.

Get more UH Cullen College of Engineering news at **www.egr.uh.edu/news.**

FALL 2007 ALUMNI EVENTS CALENDAR UH CULLEN COLLEGE OF ENGINEERING

Engineering Alumni Association Tailgates

All tailgating events begin two hours prior to kickoff and are hosted at the EAA Pavilion on the west side of Robertson Stadium

September 29 **UH vs. East Carolina** 6 p.m. **October 13** **UH vs. Rice** 2:30 p.m. **November 4** **UH vs. SMU** 7 p.m.
November 17 **EAA Homecoming BBQ, UH vs. Marshall** 4 p.m. (tailgate begins at 12 p.m.) **November 24** **UH vs. TSU** 4 p.m.

For more information about any of these events, call 713-743-4200, e-mail alumni@egr.uh.edu, or visit www.egr.uh.edu/events.

UNIVERSITY OF HOUSTON
CULLEN COLLEGE OF ENGINEERING

Office of Communications
UH Cullen College of Engineering
E316 Engineering Bldg. 2, Houston, TX 77204-4009

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