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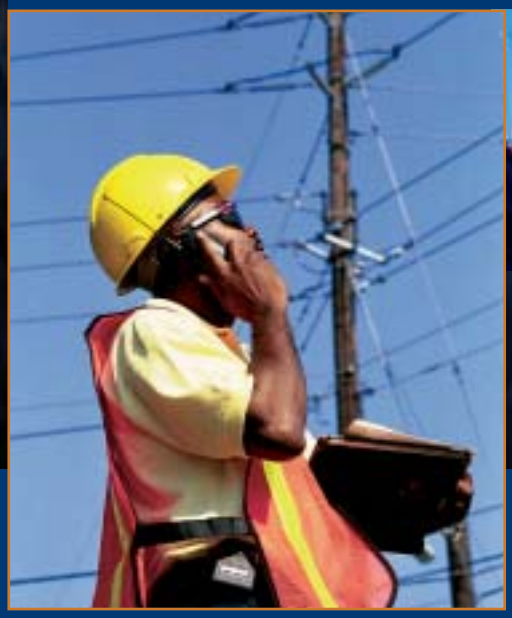
E@M

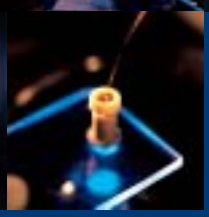
ENGINEERING @ MARYLAND

THE POWER INDUSTRY AT A CROSSROAD

INSIDE

A. JAMES CLARK SCHOOL OF ENGINEERING ▪ University of Maryland





STORIES

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Dear Alumni and Friends:

AS WE WERE PREPARING to go to press with this issue of *E@M*, we learned about the recent election of three of our colleagues to the National Academy of Engineering. Election to the academy is among the highest professional distinctions accorded to an engineer. I am extremely excited to report that the newly elected members include Jeong H. Kim, professor of the practice in electrical and computer engineering and mechanical engineering; Gerald E. Galloway, research professor in civil and environmental engineering; and Gilbert (Pete) Stewart, professor of computer science. This recognition is a testimony to the quality of our faculty and a reflection of our ascent to the league of the best engineering schools in the nation.

To meet the technological demands of the future, engineering has developed into a highly cross-disciplinary field. Due to the organizational structure of our university, which is highly supportive of cross-disciplinary endeavors, we are extremely strong and agile in establishing these collaborative efforts. Such activities have become a defining and distinguishing characteristic of the Clark School. We embrace this concept on all levels whether competing for major research awards, initiating new programs that expose our students to exciting research, or providing students with skill-building experiences that mirror the expectations they will face in the workplace.

By successfully forming cross-disciplinary coalitions, our faculty and staff have secured major block grants to fuel our research engine and initiate groundbreaking programs. In the past few months alone, we have acquired several new major grants in nanotechnology, information technology and advanced sensors, further strengthening our research programs in these areas of strategic priority. Particularly impressive is the fact that our total research awards for fiscal year 2003 represent a growth of 35 percent over the previous year.

Academic programs such as Gemstone, QUEST and Hinman CEOs are just a few examples of cross-disciplinary activities that offer our undergraduate students focused opportunities and experiences that simply cannot be found in traditional disciplinary programs. These programs enhance interaction among students and between students and faculty, as well as promote teamwork and alliances between colleges. One of our newest initiatives is a Master of Science in Engineering and Public Policy, offered jointly by the Clark School of Engineering and the School of Public Affairs. We expect to pilot the program in fall 2004. The curriculum will integrate engineering concepts and principles with public policy analysis. Once it is fully operational, this program will serve a broad spectrum of interests and market needs by offering specialization tracks in energy, transportation systems, national security, biotechnology, environment, developing countries infrastructure, manufacturing and telecommunications. We are excited about this new initiative and will keep you posted on its development.

We remain focused on making a difference in engineering education and research and in contributing to the society in which we live. We encourage your involvement with us in this endeavor.

Nariman Farvardin, *Professor and Dean*

Deep Sea Robotics Hold Clues for Space Travel

The Space Systems Laboratory of the Aerospace Engineering Department recently received a $3 million Astrobiology Science and Technology Program (ASTEP) award from NASA.

NASA will use the Clark School's space robotics technology to build a dexterous robot arm for deep submergence activities. This manipulator will be integrated onto the Woods Hole Oceanographic Institute's SEABed autonomous underwater vehicle (AUV), which will be sent under the Arctic ice cap to examine and sample marine life around hydrothermal vents.

Considerable scientific and public interest has been generated by the discovery of deep volcanic vents in the mid-Pacific and mid-Atlantic ocean rifts. The vents, which are caused by drifts in the continental plates far below the ocean, support rich biological environments that thrive based on the chemical energy of nutrients without relying on sunlight.

Recently, volcanic vents were discovered under the ice cap in the Arctic. Technology, however, does not currently exist to sample the life forms around these vents. The Clark School project will be the first to obtain biological samples from the Arctic, which can inform scientists about the similarities and differences of hydrothermal ecosystems in widely separated areas.

David L. Akin, associate professor of aerospace engineering and director of the Space Systems Laboratory (SSL), is the principal investigator for the project, in collaboration with scientists at Woods Hole. Ella Atkins, assistant professor of aerospace engineering, will be integrally involved in the project as well, developing technologies for autonomous perception and planning in order to identify, target and capture specific biological specimens. Four research staff members as well as graduate and undergraduate students are assisting in the project.

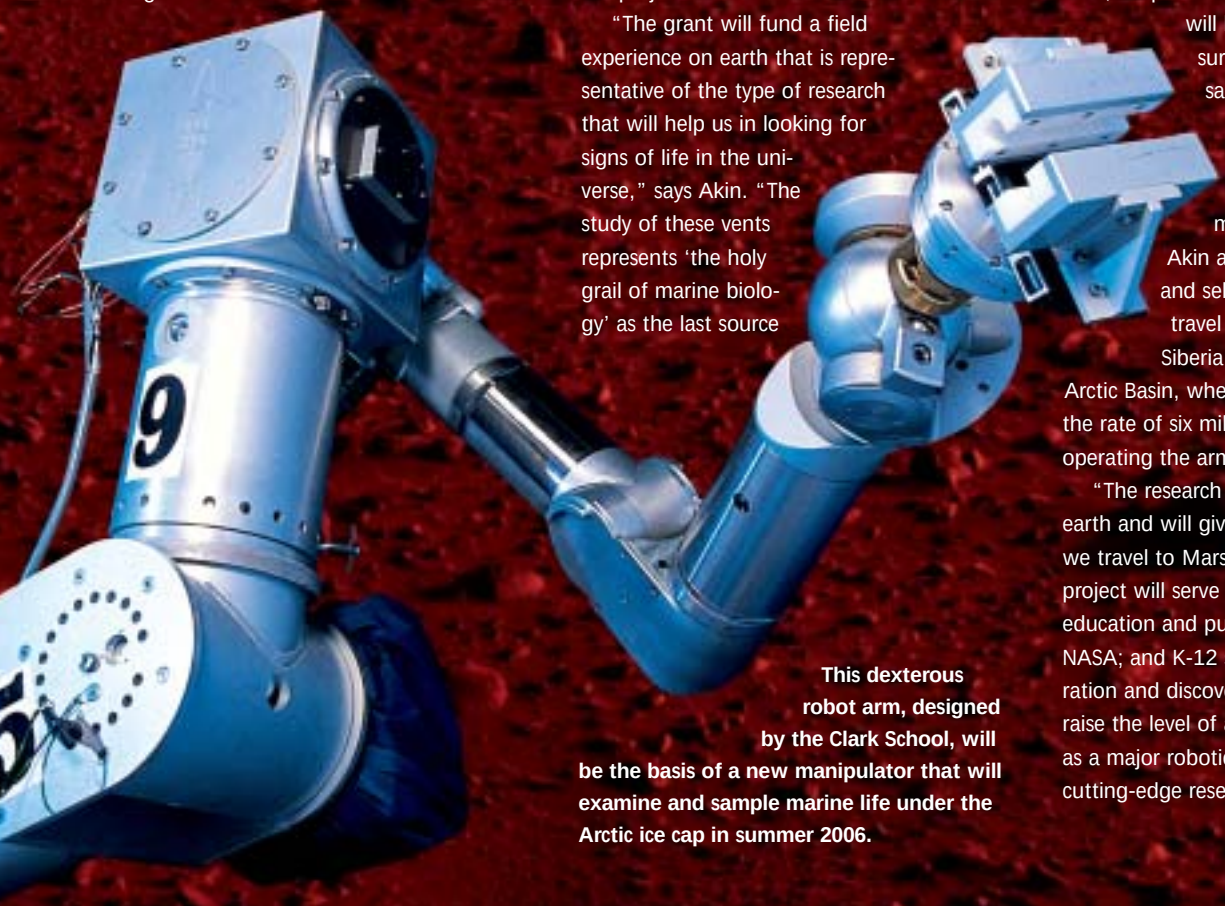
"The grant will fund a field experience on earth that is representative of the type of research that will help us in looking for signs of life in the universe," says Akin. "The study of these vents represents 'the holy grail of marine biology' as the last source of uninvestigated life."

The team will use two different AUVs. APOGEE, an automatic survey robot, will identify the likely places to look for underwater life in the hydrothermal vent. SEABed is the robot that will actually travel to the vents and take photos, but it currently has no way to interact with the local environment. Based on the SSL's experience with underwater robots and highly dexterous robotic technology, SSL will adapt robotic technology to fit on SEABed, which will allow the vehicle to directly sample vent fluids on the sea floor as well as collect samples of vent life such as tubeworms or crabs. The task will mimic sampling in planetary environments such as Mars, Europa and the comets.

The robots will dive to a depth of 5,000 meters with three tons of pressure per square inch. "We are building very thick-walled electronic housing and will fill the inside of the robot arm with oil to maintain pressure equilibrium," explains Akin. "The biggest challenge will be to bring samples to the surface at the same pressure and same temperature as the vent."

The robotic arm will be tested in a tank and in the Atlantic Ocean in the summer of 2005. In summer 2006, Akin anticipates that researchers and select Clark School students will travel to a destination north of Siberia in the ice-covered Eastern Arctic Basin, where the ridges are separating at the rate of six millimeters per year, to test operating the arm of the robot.

"The research will tell us more about life on earth and will give us greater information as we travel to Mars and Europa," he adds. "This project will serve as the center of a number of education and public outreach activities for NASA; and K-12 students can follow the exploration and discovery on the Internet. It also will raise the level of awareness of the Clark School as a major robotics contributor, conducting cutting-edge research in this field." ■



This dexterous robot arm, designed by the Clark School, will be the basis of a new manipulator that will examine and sample marine life under the Arctic ice cap in summer 2006.

Generous Gifts Power Education

Pepco and Black & Decker, long-time recruiters and research partners of the Clark School, have each made their largest-ever philanthropic contribution to the university by generously contributing to the Jeong H. Kim Engineering Building. Pepco's gift of $280,000 will establish a seminar room and Black & Decker's $250,000 gift will be used to name a computer classroom.

According to Pepco President Bill Sim, "Our business is based on engineering so we are proud to support the Clark School of Engineering with this gift. As a local business, we draw many of our employees from the university and are well aware of the importance of education to our success and to the continued success of the regional economy." Thomas Masteler, vice president of DeWALT, the industrial line of Black & Decker, adds that "our gift reflects the belief that the University of Maryland continues to be integral to improving our business. We count on the Clark School to deliver future technical leaders to us." ■

NSF Funds Project to Advance Homeland Security

In recent years, surveillance of the nation's critical infrastructure—road, water, electrical and rail systems—has become a critical component of homeland security efforts. Keeping military and law enforcement officials and disaster management teams adequately informed as they initially respond to hazardous spills, major weather events or terrorist related activities is equally important.

The military has had sustained interest in "how networks can remain connected and highly available over large areas where ships, land vehicles and airplanes need to communicate sometimes at distances 100 kilometers apart," says Stuart Milner, senior research scientist in the civil and environmental engineering department and with the Institute for Systems Research. Milner, who formerly directed research and development efforts in large-scale simulation networks and advanced mobile wireless network technologies for the Defense Advanced Research Projects Agency (DARPA) adds that, "Free space optical wireless communications that are self-organizing have emerged as a viable technology for these purposes."

High-quality, video-based surveillance with advanced specialized sensors and high bandwidth communications, which are portable, secure and can be easily reconfigured, are the focus of a $1.2 million project funded by the National Science Foundation and led by Milner.

Milner is joined on the project, called "Sensors: Optical Wireless Sensor Networks for Critical Infrastructure Surveillance," by Christopher Davis, professor of electrical and computer engineering; Uzi Vishkin, professor of electrical and computer engineering and the Institute for Advanced Computer Studies; Gregory Baecher, professor of civil and environmental engineering; and Philip J. Tarnoff, director of the Clark School's Center for Advanced Transportation Technology.

The five researchers are creating sensor networks with high definition camera signals that will connect to the Internet using narrow, invisible laser beams operating at 1.550 nanometers. Large quantities of video data may be transferred in this way at rates that can be hundreds of times faster than conventional radio frequency wireless networks.

In addition, the optical wireless network does not require large, possibly unsightly, antenna towers.

According to Milner, these communication devices have the capability to autonomously point transceivers to acquire information, such as changing atmospheric conditions or problems with network links and switches, and can reorganize based on that information to form a new physical network backbone. This ability to instantly reconfigure a network is vital to monitoring and responding to major natural disasters or other incidents and to providing real time traffic and evacuation response. The devices, or nodes, can be mounted on rail cars, police vehicles, trucks or barges and can quickly adjust the flow of information within the communication network through the exchange of detailed data between fixed and mobile nodes.

Video surveillance using a Laser Communication Link, which is indicated by the red dot.

"Important to the success of this project is the team we have put together—a multidisciplinary group of electrical and civil engineers and a computer scientist—combining expertise in optical and laser engineering, parallel and distributed algorithms, transportation systems, communications, network operation and the monitoring of civil infrastructures," adds Milner.

"For the Clark School, we are pioneering technology that solves the 'last mile' problem—for example, bridging the gap between high data rate surveillance sources and existing high data rate fiber optic Internet backbones," says Milner. "This project, one of the first civilian applications of these networks, has great potential for homeland security and for critical infrastructure protection." ■

Outstanding Leaders Join Board of Visitors

The Clark School of Engineering Board of Visitors welcomes 10 new members to work closely with the dean to promote the mission, goals and strategic plans of the school.

JEAN-LUC ABAZIOU is a venture partner at Highland Capital Partners, which focuses on communications and information technology investments and specializes in networking infrastructure and wireless opportunities. Previously, he was president of Ericsson IP Infrastructure and was former president and chief executive officer of Torrent Networking Technologies, acquired by Ericsson. He holds a M.S. in computer science and electrical engineering from Ecole Superieure d'Electronique de l'Ouest in Angers, France.

BERT BLACK, a partner with Diamond, McCarthy, Taylor, Finley, Bryant and Lee, LLP, has over 16 years experience in environmental and product liability litigation, and is a nationally recognized expert on scientific evidence issues. Black received a bachelor's degree in civil engineering from Maryland, a master's degree in civil engineering from Georgia Institute of Technology and a law degree from Yale Law School. A registered professional engineer in Maryland, he is past chair of the American Bar Association Section of Science and Technology.

WILLIAM R. CALHOUN, JR., executive vice president and regional executive officer of Clark Construction Company, has directed projects that include renovations to the Pentagon and the National Institutes of Health, and the design/build of the MCI Center Arena in Washington, DC. He is a member of the External Advisory Board of the Georgia Tech School of Civil and Environmental Engineering, where he earned a bachelor's degree in civil engineering.

DELON HAMPTON is chairman of the board of Delon Hampton & Associates, Chartered, a consulting and design services firm covering civil, structural and environmental engineering, construction management and planning. Hampton has published extensively, and has held a number of positions in research and academe, including assistant professor at Kansas State University and professor of civil engineering at Howard University. He received a B.S. in civil engineering from University of Illinois and a M.S. in civil engineering and a doctoral degree from Purdue University.

HEMANT KANAKIA founded Torrent Networking Technologies, which would become the core of Ericsson's global Internet provider strategy and the Internet provider infrastructure division. Kanakia also started Photuris, Inc., an optical networking equipment start-up and Gemplex Internet Inc., an international Internet provider service company building a global backbone and value added services to 32 metropolitan communities around the globe. He serves on the boards of PriceHawk, Photuris, Inc., Pipal, Inc. and ViaGate Technologies and is a private investor in start-ups, focusing on Internet infrastructure companies. He earned a bachelor's degree in engineering from Indian Institute of Technology, a master's degree from Case Western Reserve University and a Ph.D. in electrical engineering from Stanford University.

BELKIS LEONG-HONG is president of Knowledge Advantage, Inc., a company specializing in strategic business planning, policy and program analyses, strategic business development, and delivery of information technology and knowledge management solutions to commercial and government entities. Leong-Hong established and ran the first department-wide data administration function for the U.S. Department of Defense (DoD). She has published more than 30 technical reports and articles on data administration, software engineering and information management, and serves on numerous boards. A mathematician and computer scientist by training, she holds a B.S. from Hunter College and a M.P.A. from American University.

J. PHIL SAMPER, co-founder of Gabriel Venture Partners, has been involved in more than 20 venture capital deals, including AccessLine Communications, CrossMedia Services, Liquid Markets, PlaceWare, Sylvan Learning Systems and Virtual Technologies. He is a former vice chairman and executive officer of Eastman Kodak Company, where he was directly responsible for 70 percent of Kodak's worldwide operations and led a restructuring of the company to individual business units. He received a B.S. in business administration from University of California, Berkeley and a M.S. in management from Massachusetts Institute of Technology, where he was a Sloan Fellow.

SAUL SELTZER owns Saul Seltzer Construction Corporation, a private construction company in Kenilworth, New Jersey specializing in local, industrial and commercial construction. He previously was chief engineer with W.D. Snyder and Son and served as a chief engineer for Tower Marts and as a consulting engineer for Maryland Highway Design. Seltzer is an active member and fellow of the National Society of Engineers and past president of the New Jersey Society of Professional Engineers. He received a B.S. in civil engineering at Maryland and completed graduate work at Johns Hopkins University.

CHARLES WAGGNER is executive vice president at Esselen Associates Co., an international petroleum-chemical marketing firm. He graduated from Maryland with a bachelor's degree in chemical engineering. Following graduation, he worked in petrochemical sales for the Exxon Corporation, and then worked for the corporate planning department of Cosden Oil. Waggner also holds a law degree from Loyola University. He and his wife, Joan, have established the Waggner Scholarship for Clark School chemical engineering students.

PEDRO WASMER, founder and president of Somerset Capital Group, Ltd., began his career working for two civil engineering consulting firms before holding positions at IBM, Honeywell and DPF, Inc., a Fortune 500 high-technology equipment leasing firm. Wassmer started his own equipment-leasing firm, which was acquired by a savings bank. He later formed St. James Leasing, Ltd. and Somerset Capital Group to manage its assets, marketing and operations. Since 1995, *Hispanic Business Magazine* has recognized Wasmer's companies among the top 500 Hispanic-owned companies in the country. He obtained a B.S. in civil engineering at Maryland and completed graduate courses in Latin American Studies at American University.

Professional Recognition and Honors

WILLIAM BENTLEY, the Herbert Rabin Distinguished Professor of Engineering and director of the Bioengineering Program, received the 2003 Clark School of Engineering Outstanding Faculty Research Award. This award recognizes his exceptional contributions to chemical engineering and bioengineering research, especially in the application of green fluorescent protein in monitoring protein production in insect larvae.

KAYE BRUBAKER, associate professor in civil and environmental engineering, received the 2003 E. Robert Kent Outstanding Teaching Award for Junior Faculty. Her peers describe her as one of the most motivated and dedicated instructors in the department and a leader in the use of technology in the classroom.

JAMES DUNCAN, professor of mechanical engineering, was recognized as a 2004-2005 University of Maryland Distinguished Scholar-Teacher. This honor recognized Duncan's outstanding scholarly achievement along with equally outstanding accomplishments as a teacher.

SANDRA GREER, professor of chemistry and chemical engineering, received the Francis P. Garvin-John M. Olin Medal. The Garvin-Olin Medal of the American Chemical Society has been awarded annually since 1935 for scientific achievements. The award comes with a $5,000 prize. Greer will present addresses to the physical chemistry division and to women chemists at the society's next national meeting.

ASHWANI K. GUPTA, professor of mechanical engineering, was awarded the American Society of Mechanical Engineering's James Harry Potter Gold Medal in recognition of eminent achievement in the science of thermodynamics. He was also invited to be a member of the Nanotechnology Technical Advisory Group to the U.S. President's Council of Advisors on Science and Technology.

PATRICK O'SHEA, professor of computer and electrical engineering and the Institute for Research in Electronics and Applied Physics (IREAP), was elected fellow of the Institute of Electronics Engineers for contributions to charged particle accelerators and free electron lasers.

DARRYLL PINES, associate professor in aerospace engineering, was recognized as the 2002-2003 Faculty Advisor of the Year by the Provost's Commission on Advising. This honor recognizes his excellent advising services to students.

ADEL SHIRMOHAMMADI, professor of biological resources engineering, received the Hancor Soil and Water Engineering Award of the American Society of Agricultural Engineers (ASAE). The Hancor Award, one of ASAE's top honors, was given to Shirmohammadi for his distinguished accomplishments as a teacher and faculty member and for outstanding research in hydrologic and water quality management and non-point source pollution assessment.

Engineer the Future and Build Your Fixed Income

Want to make a gift to the School of Engineering that provides you or a loved one with a fixed, guaranteed, lifetime income?	✓
Do you have assets including cash and appreciated securities to make a gift of $5,000 or more?	✓
Do you own stock or cash assets yielding five percent or less annually?	✓

Your affirmative answers to these questions make you a good candidate to establish a Charitable Gift Annuity, which can support the future of engineering and benefit the Clark School, as well as yourself or a loved one.

Establishing a Charitable Gift Annuity at the University of Maryland using cash assets or appreciated securities provides important benefits such as:

- Building lifetime income for yourself or someone you designate by making sound investment decisions with potentially higher rates of return
- Ensuring continued academic quality and achievements of the Clark School of Engineering
- Realizing your personal philanthropic objectives while advancing technology and the impact of engineering in our society.

For more information and a no-obligation gift annuity illustration tailored to your age and circumstances, please contact:

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Age	One-life Rate
50	5.3
60	5.7
70	6.5
80	8.0
90+	11.3

Ages*	Two-life Rate
50/50	4.7
60/60	5.4
70/70	5.9
80/80	6.9
90/90	9.3

**Two-life return rates vary. Rates above apply to originator and beneficiary of the same ages.*

A. JAMES CLARK
SCHOOL OF ENGINEERING

Mechanical Engineering

Research & Education for the 21st Century

Mechanical engineering laboratories in the Clark School used to be filled with black-topped tables, large gears, mercury thermometers, inclined manometers with colored water and students huddled over a clumsy mass of equipment. Today, much of the cutting-edge work conducted in the department takes place on computers and tiny chips as researchers use the latest technologies in their quest for engineering breakthroughs. By Gary Gately

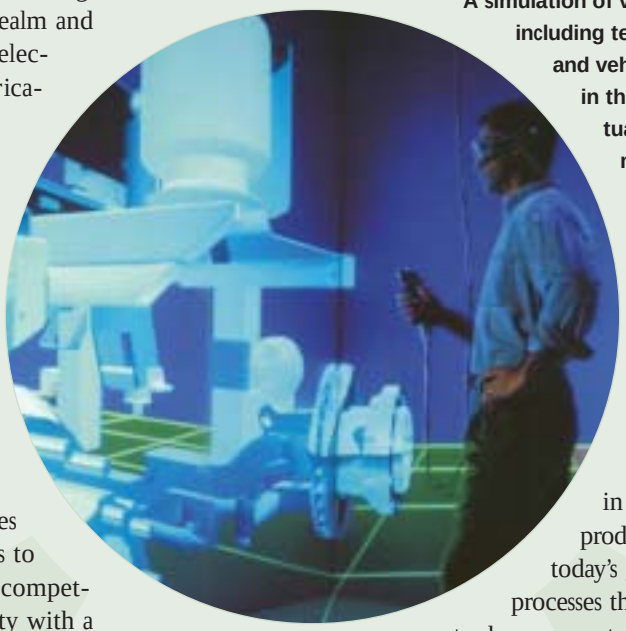
Don DeVoe, an associate professor of mechanical engineering, uses biochips to analyze biomolecules as he searches for ways to detect biological warfare agents and identify protein markers for early-stage cancer.

Professor of the Practice Robert E. Fischell, a prolific inventor, is developing an implantable device that could detect a heart attack within 60 seconds, then immediately release a chemical to dissolve the clot.

And Michael Pecht, George E. Dieter Professor of Mechanical Engineering, is working with industry colleagues to develop sensors half the size of a dime that precisely verify the status of critical jet engine parts to determine how long they will last.

Modern-day mechanical engineering, often conducted in the microscopic realm and involving biomedical products, electronic computers and microfabrication, is vastly different from the "macro-world" of steam-powered machines, steelmaking equipment, nuclear power plants and rockets for space exploration that dominated the field in the 20th century. Today, teams of experts from multiple disciplines collaborate on efficient, quick product development for the ever-changing commercial marketplace, rapidly exploiting advances in micro- and nanotechnologies to develop products with a strong competitive advantage. Dedicated faculty with a focus on emerging technologies and techniques have helped to more than double annual research expenditures in the Clark School's mechanical engineering department to nearly $16 million in just six years, with funding provided by federal agencies, national laboratories, large and small corporations, foundations, the state and the university.

Changes in the field—particularly the increased emphasis on the critical facets of product development—have profoundly affected how mechanical engineering is taught today.



A simulation of vehicle dynamics, including terrain typography and vehicle suspension, in the university's virtual reality environment facility.

(Far left) Students work in the Maryland MEMS lab on a polymer biochip (left) used in DeVoe's research. The biochip, developed in close collaboration with Professor Cheng Lee's group in the chemistry department, contains thousands of microchannels for analyzing protein signatures.

Students no longer just hit the books and rely on copious lecture notes. They work on product design directly with companies like Black & Decker; participate in complex, hands-on design projects that focus on unmet societal needs; and compete in national events that test their skills at building robots, human-powered submarines and more efficient automobiles.

ACCELERATING PRODUCT DEVELOPMENT

Avram Bar-Cohen, professor and mechanical engineering department chair, offers a broad perspective. "The salient feature of the practice of mechanical engineering in the 21st century is the wide range of 'length scales' that are encountered in everyday work—from the robot arm of a space shuttle to the valve in a refrigeration system and all the way down to nano devices that can move a molecule or hold one while another molecule is attached," he says.

Moreover, states Bar-Cohen, "Much of the work of modern mechanical engineers involves computer simulation with numerical models, computer-aided design or computer-aided manufacturing."

The broad application of computers in mechanical engineering speeds the product development process, so critical in today's global, competitive marketplace, where processes that once involved trial and error and took years must now be completed in just months.

"Today's product creation cycle is compressed," Bar-Cohen explains. "If the product idea is good, competition in the marketplace requires that you quickly move to a working prototype, then large-scale manufacturing and simultaneously develop a marketing and distribution network that will make this product broadly available."

As a result, he says, "Continuing to work with a plodding trial and error process means you're essentially dead in the water in today's market. If you're too slow in product development, your competitor could already be selling his product while you're still trying to refine yours."

Computer modeling and simulation, Bar-Cohen adds, reduces product development time by enabling mechanical engineers to test both the performance of the product and the

manufacturing process in the virtual world. Thus, the computer-driven product realization process is far superior to the traditional trial and error process of going through an iterative sequence of physical steps.

Satyandra Gupta, associate professor in the department with a joint appointment in the Institute for Systems Research (ISR), has worked with students to develop software that automatically produces accurate mold designs for complex parts. The software works with computer models of the part created either by using a computer-aided design system or through reverse engineering of existing parts. Using this software, it now takes minutes instead of days to design a wide range of molds, including those used for plastic automobile parts, prosthetics, laptop computers, telephones and kitchen appliances like mixers.

Students re-engineer a Ford Explorer to lower emissions and improve fuel economy as part of the national "Future Truck" competition.

Rapid advances in nanotechnology and biological and information technologies have, by necessity, blurred some traditional boundaries among the disciplines in engineering, biology and life sciences. "Even within engineering, it can be difficult to define clean boundaries between the engineering disciplines," says DeVoe, who is also a core faculty member in the Clark School's new bioengineering program. "There's been tremendous bleed-over between the disciplines," he adds.

For example, in developing a tiny chip to detect multiple biological warfare agents in air, water and tissue samples, DeVoe also works with faculty in chemistry and with industry experts at Rockville-based Calibrant Biosystems. DeVoe hopes the "lab-on-a-chip"—which has received funding from the university's Maryland Industrial Partnerships Program—also will measure and identify proteins that signal early-stage cancer in a small collection of cells, rather than finding the biomarkers later through a traditional biopsy. "Literally, it's the difference between life and death," DeVoe says, calling the cross-disciplinary team crucial. "If I tried this by myself, I'd never be successful."

Other faculty researchers also focus on microscopic innovations. Pecht envisions a microchip beneath the skin with tiny needles that could draw and analyze blood, then dispense necessary medication to patients. Henry Haslach, a mechanical engineering lecturer, applies fracture mechanics—how forces can deform or fracture solid bodies—to discover when an aneurysm would rupture in hopes that surgery, if necessary, could be performed well in advance.

> "I think this hands-on experience working in a group is the best way you can imagine to teach engineers-to-be. ... All the elements of what it takes to be a successful engineer are wrapped up in this project."

TEACHING FOR THE MARKETPLACE

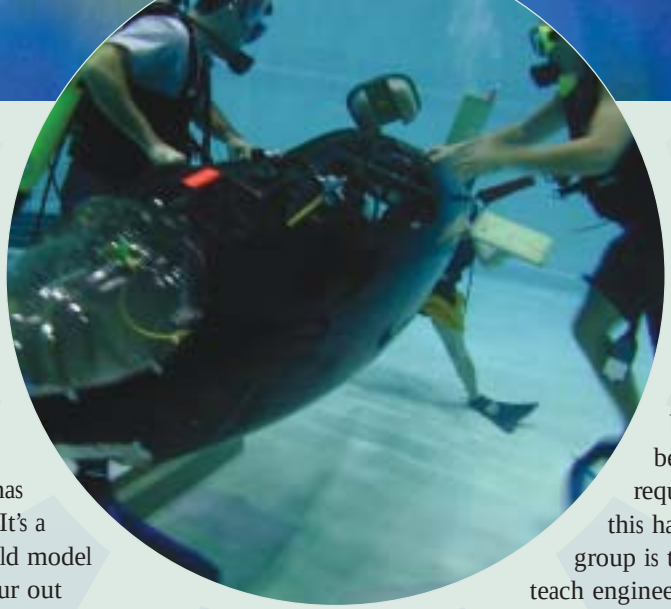
To prepare students to work in the field, the department focuses on bridging the gap between academe and the industry. That translates into student projects that use design, problem resolution and project management skills in collaborations with others—sometimes outside the department and even outside the school.

The QUEST program, for instance, is a collaboration between the Clark School and the Smith School of Business that is built around four team-based courses. QUEST stresses the importance of teaching business skills to engineering students, allowing them to understand the needs of investors as well as the market and to analyze costs and benefits in decisions involving design, material selection, manufacturing and supply chain management.

QUEST students from the Clark and Smith schools and those studying computer science, math and physical sciences begin this highly competitive program in their sophomore or junior years. A senior-year practicum in workplaces such as America Online, General Electric, IBM, T. Rowe Price and KMPG provides hands-on, group problem-solving opportunities, including seeking ways to use machinery and workers' time more efficiently by eliminating unnecessary production steps.

Product Engineering and Manufacturing (ENME 371) is yet another example of bringing the workplace into the classroom. In this course, students form design teams and put their skills to the test through competitive analysis and redesign to improve commercial products such as DeWALT tools, the industrial line of Black & Decker tools. For example, students recently worked on modifying a belt clip for a drywall screwdriver to improve its strength and durability and designed an anti-theft device in which a power drill would require a key to operate.

Black & Decker, headquartered in Towson, Maryland, supports the course by sending several engineers each year to the Clark School to work directly with the student teams and to lecture on topics such as team product development, generating and testing concepts, manufacturing systems and overcoming technical challenges. They also consult with students on class projects.



The *RSR Fourier* submarine, designed and built by Clark School students, undergoes testing in preparation for the International Submarine Races.

"The Black & Decker employees are tough critics and invaluable mentors," explains Linda Schmidt, associate professor of mechanical engineering who teaches the class. "This course demonstrates the direction of mechanical engineering education at the University of Maryland," adds Schmidt, who has a joint appointment with ISR. "It's a different kind of learning. The old model was that the professor would pour out knowledge while the students watched and listened. They learned from reading and doing example problems from textbooks."

Today, she says, hands-on courses provide invaluable experiences that prepare students for the rising expectations of industry. "Courses like these, with real-world components, are more demanding," Schmidt adds. "But there's constant pressure in the real world to make the product better, faster and cheaper."

Haslach states most design courses at other universities assign students a design problem and then have them solve it. Instead, he prompts students to identify design challenges on their own and come up with solutions. "The whole point of the course," he explains, "is to try, as well as possible, to teach creativity—to teach students to not just follow the status quo, but to be creative."

Clearly, his students have met the creative challenge. Working in six-member groups, students have designed: a machine that recycles sawdust into logs; a mechanical car seat that moves forward, turns and tilts assisting elderly drivers entering or leaving their cars; a machine that digs holes and plants grass seedlings in the Chesapeake Bay; a robot that mops floors, turning when its sensor detects walls; and a system that extracts methane gas from cow manure twice as efficiently as current systems.

To simulate working in a competitive marketplace environment and to motivate undergraduate and graduate students to apply and test what they have learned, mechanical engineering students are encouraged to enter national and international competitions. A submarine designed and built by students, the *RSR Fourier*, won first place for speed last summer in the one-man, propeller-driven category of the International Submarine Races, sponsored in part by the U.S. Navy and the Foundation for Underwater Research and Education. Another group of students spent a year designing and building a solar-powered house on the National Mall in Washington, DC, that was awarded fourth place in a Solar Decathlon sponsored by the U.S. Department of Energy and private-sector partners, including Data Systems Corp. And for the "Future Truck" competition, sponsored by the Department of Energy and Ford Motor Company among others, students re-engineered a Ford Explorer to lower emissions and improve fuel economy without sacrificing performance, safety or affordability.

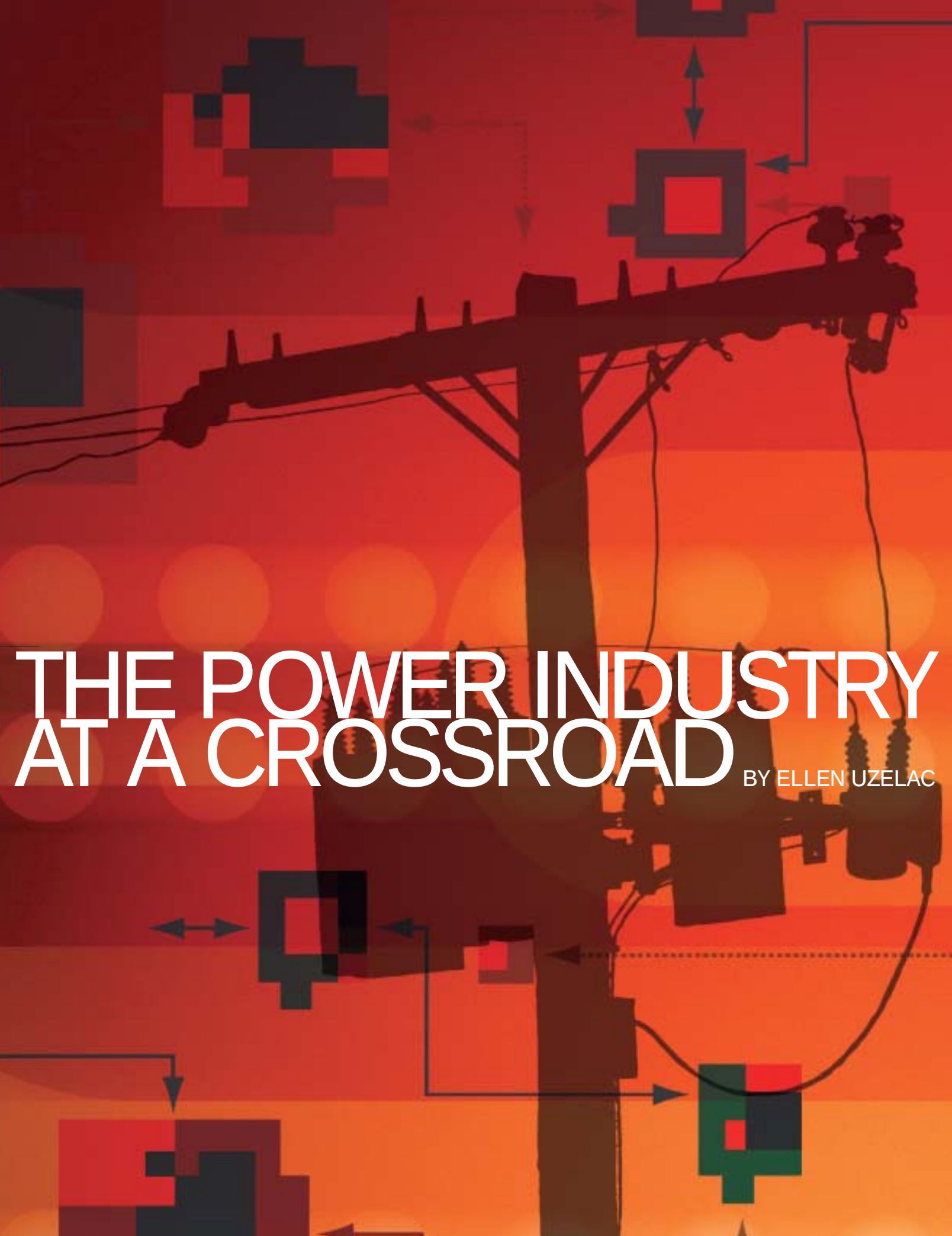
David Holloway, a mechanical engineering professor who was named the 2003 Advisor of the Year by the National Science Foundation, believes the truck competition requires considerable ingenuity. "I think this hands-on experience working in a group is the best way you can imagine to teach engineers-to-be," he shares. Redesigning the truck into a hybrid that runs on a blend of electricity and fuel that is 85 percent ethanol forced students to consider not only all the engineering facets but also costs and marketing. "All the elements of what it takes to be a successful engineer are wrapped up in this project," Holloway acknowledges. "Students have to analyze cost and weight, deal with complexity and embedded software and learn that there is not just one answer waiting for them in the back of the book."

Indeed, as Bar-Cohen offers, "Mechanical engineering at the Clark School is clearly not your grandparent's engineering department."

Driven by a creative, talented, and dedicated team of faculty, the department is expanding horizons and shrinking scales to assure that its graduates are fully prepared to play an ever larger role in the commercialization of cutting edge technology.

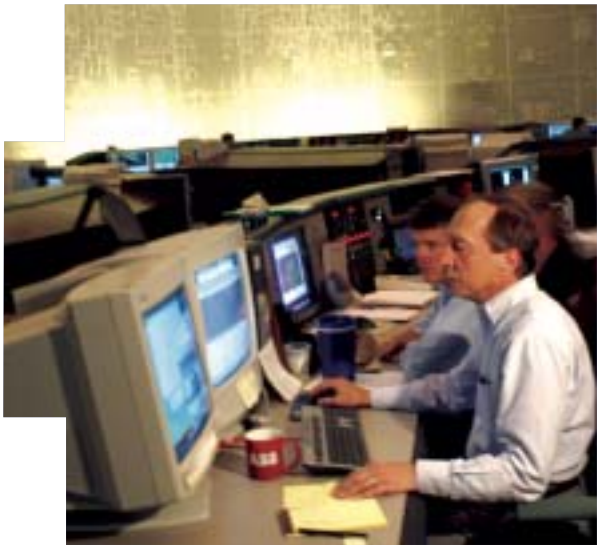
* * * *

Gary Gately is a Maryland-based freelance writer who was a reporter for The Baltimore Sun *for 11 years. He has written extensively for publications that include* The New York Times, Newsweek, Business Week *and* The Chicago Tribune.



THE POWER INDUSTRY AT A CROSSROAD

BY ELLEN UZELAC



BGE Storm Center

There are many who would like to forget the rash of storms that pelted the mid-Atlantic region last summer. First, four fierce August storms knocked power out for a record-high 320,000 customers of the Washington, DC-based utility Pepco (Potomac Electric Power Co.). Some residents were without electricity for seven uncomfortable days in the region's muggiest month of the year.

That was just a warm-up.

In September, Tropical Storm Isabel, downgraded from a hurricane, hit the DC area. The worst storm to strike the region in 50 years, Isabel caused power outages for several million customers, of which 550,000 were Pepco subscribers.

"That's a number we have never seen before," notes William J. Sim, president of Pepco and a member of the Clark School's Board of Visitors. "Even with advance preparation for the storm, we never thought we would see as many as 76 percent of our customers out."

An East Coast power grid failure, a rash of summer storms and Tropical Storm Isabel, which affected millions of businesses and residences from North Carolina to New England, occurred within weeks of one another—a series of events that put power industry executives on alert.

In the months following, the current state and future of the power industry have been debated on Capitol Hill, at state public service commission hearings, in industry executive suites and in university research labs. Add to that the much heralded U.S. energy bill, which includes mandatory reliability standards and penalties for violators, and you have a national conversation about power.

What does the industry need to do better and did last summer's widespread outages teach the industry anything? What innovations or technological advances are emerging and will pol-

Continued on next page

icy changes be forthcoming? As Ken DeFontes Jr., vice president of electrical transmission and distribution for BGE (Baltimore Gas and Electric Co.), observes, "At some point, we have to become comfortable with the questions: What are the risks we are willing to take and how much are we willing to pay?"

Assessing the Industry: Supply and Demand Disconnect

"Recent events exposed increased vulnerability of utilities to inclement weather," states Isaak Mayergoyz, Clark School professor of electrical and computer engineering and a noted researcher and author on the subject of power engineering.

"Power is an integral part of our everyday life," adds Mayergoyz, who established the university's power engineering program in the 1980s with the support of BGE, Pepco, Virginia Power, Bechtel, and the GE Foundation, which in turn, hoped this program would provide them with more prepared employees. Today, the Clark School's power engineering class with 60 students is one of the largest in the nation.

"When you consider the case of the August 14 power grid failure, when electric systems in eight states and parts of Canada shut down, affecting 50 million people, this isn't just about inconvenience, but a public issue that becomes a policy issue because the outages affected so many people at the same time," Mayergoyz explains.

The state of today's power industry can not be fully appreciated without taking a look at its past. Mayergoyz calls the industry a "marvel of the last century," producing electric power that was "easily accessible, very reliable and sufficiently cheap."

A number of circumstances, however, tipped the industry's balance in the 1970s and 1980s: more cyclic changes in the economy, power demand fluctuations and difficulties in forecasting long-term demand, among others.

"In order to generate electrical power you have to build power plants. It takes about 5 to 10 years to build modern plants and you have to make sure there will be enough power demand to recover construction costs," offers Mayergoyz. "With the economy being so global and dynamic, it is hard to predict demand. The inability to accurately forecast 5 to 10 years ahead has made it virtually impossible to match power supply to demand. Is it any wonder why utilities have been reluctant to invest in the construction of new power plants?" In fact, much of Mayergoyz's research, which has been supported by the U.S. Department of Energy, has focused on the analysis of power losses and improving the efficiency of power equipment to lower costs.

In the 1990s, the electric utility industry believing it was not reaping an adequate return on investment, dramatically slowed upgrades and expansions of the power grid—from $5 billion a year to $1 billion a year, according to Reinhard Radermacher, professor of mechanical engineering and director of the university's Center for Environmental Energy Engineering (CEEE).

"The infrastructure is aging," he says. At the same time, the demand continues to increase, which ultimately leads to a bottleneck. If nothing else, the outages last August and September served as a powerful wake-up call.

"There is no way to stop blackouts from happening altogether," notes Eyad H. Abed, professor of electrical and computer engineering and an expert in the stability and control of power systems. "The cost of ensuring that there's never another blackout is phenomenal."

Abed, who is also director of the Institute for Systems Research, believes important lessons can be learned from the summer's events. "Now is the time for the community—the power companies, policy makers, researchers and academics—to work together as a team to understand why the power grid failure happened," he offers. "Further, we need to re-examine what kind of research is needed to minimize the possibility of escalating blackouts in the future."

Systems for the Future

Indeed, the heightened attention should stimulate new funding for researchers like Abed, who is developing monitoring tech-

Pepco President Bill Sim out in the field.

Mechanical Engineering graduate student, Xiahong Liao, troubleshoots the microturbine at the Cooling, Heating, and Power (CHP) Integration Test Center at the University of Maryland. The goal of the center is to deliver a small packaged CHP system that is grid independent.

niques to recognize when a power system is on the edge of instability. Abed's work focuses on creating automatic alerts when a system is close to the edge of its "stable operating envelope." With such monitors in place, Abed says, system operators "will conceivably be in a position to prevent the onset of instability in the first place, using controls that are far less drastic than would be needed if an actual blackout occurred."

Radermacher's work would also benefit the public. His research unit, part of a core of U.S. and global leaders exploring the field, is testing a new generation of much more capable integrated systems for cooling, heating and power applications. "This technology is actually about 100 years old, but the East Coast power grid failure has focused renewed attention on it," relates Radermacher. And advances in the integration of the equipment and its controls and diagnostic capabilities continue to make the technology more feasible and more accessible, he shares.

Chung Li-Tseng, assistant professor of civil and environmental engineering who specializes in the financial aspects of engineering, is also involved in research that parallels today's headlines. His real options-based model for forecasting electricity generation adequacy in a competitive power industry involves such factors as load growth, cost characteristics, market mechanisms and physical limits of generating units. "These recent events in the power industry indicate the importance of techno-economic analysis," Tseng says.

Moreover, they underscore the breadth and depth of both the practice and educational component of engineering. "One implication for engineering education is that students should learn not only about technical subjects but also about management, communication and decision-making," notes Tseng, who cites how engineering solutions require much more than a knowledge of the technical aspects of any given problem.

In fact, stronger management, improved communication and collaborative decision-making are all key challenges facing an industry that is only partially deregulated and has no clear national policy directive. As senior vice president for engineering at Northern California-based power generating firm, Calpine Corp., Robert Fishman, Ph.D. '80, knows the ins and outs of the industry as well. He advises Calpine's business units on the technological aspects of power generation, manages 75 engineers nationwide and oversees the design of the firm's new power projects.

"Until we have a more coherent national policy on how this grid system is supposed to work, I wouldn't be surprised if events like this occur again," says Fishman. "To date, there hasn't been any real global planning. The utilities are largely still regulated at the state level and the Federal Energy Regulatory Commission has limited authority." Fishman warns, "If we continue to underinvest in the system, a grid failure is going to happen again."

More importantly, says Fishman, the transmission system is used nowadays to move power over huge distances rather than short, regional hauls, which was its original purpose. "We are trying to operate a system in a way it really wasn't designed to run," he notes. "That's at the heart of what went wrong in August."

Or as Abed explains, "It is not like connecting transportation through the interstate systems. Instead, the laws of physics determine which path electric power takes."

"When policies change without taking into account the laws of physics, you will see trouble," he notes. "Policy has to be tied into the engineering and science of power systems. Policy and technology can not be decoupled."

Ensuring Greater Reliability

There is little disagreement that the industry must do a better job to ensure greater reliability to address a major concern in the public's eyes. Sim's firm is pushing Congress to create mandatory transmission reliability standards and to repeal the Public Utility Holding Co. Act of 1935—hallmarks of the pending U.S. Energy Bill.

Transmission reliability standards, Sim says, "would make sure that all parties are playing by the same rules." DeFontes adds, "Nationally, we need to put more consistency and accountability into reliability standards."

Of the holding company law, borne out of the collapse of utility holding companies and abuse of operating companies during the Great Depression, Sims says, "It was written in the 1930s when conditions in the industry were much different. It is no longer necessary and its presence is stopping some companies, oil companies for example, from investing in this industry." The Utility Act

severely limits diversification and expansion of utility companies and restricts power production by non-utility companies.

Clearly, upgrades to the transmission system need to be made. Industry experts like Fishman and Radermacher are also calling for the construction of new plants. "The only quick solution to improving the infrastructure is distributed generation," Radermacher says. "That means having large engine-driven power plants or gas turbine power plants in strategic locations where supply through the grid is not fully guaranteed today."

DeFontes agrees, "One of our biggest challenges is finding sites and constructing new facilities where they are needed. Consumers want electricity for all the things that enhance the quality of their lives. But the fact remains that those same consumers do not want transmission lines in their backyards."

"The public should be more sympathetic about the difficulties the industry is going through because it's in the public interest to have strong and prosperous utility companies," notes Mayergoyz.

At the same time, researchers are imploring the industry to more readily embrace innovation. "Whenever we need power, we plug in and we must have it. Because of this high emphasis on reliability, power companies are conservative. They are reluctant to introduce new innovations until and unless they prove that their standards of reliability are not compromised," observes Mayergoyz.

Among the emerging approaches and innovations that have the industry buzzing are technology to allow companies to load more voltage onto existing transmission towers; superconducting technology and materials that could result in promising new designs of everything from power generators to power lines such as Mayergoyz's work; more advanced, holistic monitoring and control systems for the power grid such as Abed's work; and improved control centers with enhanced screens and color-coded maps of the local and surrounding region with voltage levels and power flows updated in real time.

Abed expresses concerns regarding the continuing increase in demand for power without simultaneous expansion of generation and transmission, without adequate technological innovation and without careful examination of policy issues related to industry regulations.

"The power system problems that we have seen recently bring to light important issues. If we don't heed today's warnings, tomorrow could be much worse," cautions Abed.

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Ellen Uzelac is a former national correspondent for The Baltimore Sun. *She writes regularly for* The Baltimore Sun, American Style *and* Baltimore SmartCeo Magazine.

Clark School to Host Region's New Energy Center

The Maryland Energy Administration (MEA) is partnering with the Clark School's Center for Environmental Energy Engineering (CEEE) to establish one of six Regional Application Centers for Cooling, Heating and Power (CHP).

The new mid-Atlantic center will promote CHP technologies in the District of Columbia and six states—Delaware, Maryland, New Jersey, Pennsylvania, Virginia and West Virginia. It will be managed by CEEE staff and located in Glenn L. Martin Hall.

"We have a lot of experience in cooling, heating and power based on the experiments we are conducting," notes Reinhard Radermacher, CEEE director and professor of mechanical engineering. "As the host of the Mid-Atlantic CHP Application Center, our purpose it to support interested parties in installing CHP systems on their own, wherever it is economically feasible."

Radermacher notes that many entities have expressed commercial interests in the new technology. The center's role, he explains, is to serve as an independent consultant providing background information and helping interested participants determine if conversion to CHP makes sense for their facilities.

The center is funded through the MEA. The university and MEA have worked in partnership to secure $300,000 in federal funding from the U. S. Department of Energy's Office of Energy Efficiency and Renewable Energy (DOE). "The center will help lower energy costs through energy efficiency and help maintain the electricity grid's reliability through the use of distributed energy technologies," according to MEA Director Michael Richard.

The grant, awarded on a competitive basis, is distributed through the DOE's State Energy Programs Office and reflects the successful research conducted within the center.

From Concept To Market: Boot Camp Offers Primer on Entrepreneurship

More than 300 college students from nine universities in the region were put through a day of mentally challenging sessions in a different type of boot camp this fall. The university's third Technology Startup Boot Camp hosted by the Clark School's Maryland Technology Enterprise Institute (MTECH) along with the National Collegiate Investors and Innovators Alliance (NCIIA) was designed to equip students with the information, technology and tools to one day launch their own companies. Venture capitalists, intellectual property attorneys, marketing experts and entrepreneurs shared their expertise with students on how innovation can be transferred to promising commercial ventures.

Event attendance has more than tripled since the boot camp's first year, a strong indicator of the Clark School's continuing success in developing and promoting new commercial products and services and entrepreneurs. The boot camp is managed by the Hinman Campus Entrepreneurship Opportunities (CEOs) program, a joint venture of the Clark School and the Smith School of Business that brings undergraduate students together in a dynamic, living-learning experience that spurs the formation of new ideas and creative ventures.

"The region is a hotbed for research," says David Barbe, executive director of MTECH. "The purpose of the boot camp is to help faculty and students move their innovative research out of the laboratory and into the commercial sector."

College Park students, as well as those from regional universities, including Johns Hopkins, George Mason, George Washington, Howard, and University of Maryland Baltimore County, received plenty of free advice and information from venture capitalists and lawyers with firms such as Ernst & Young, SpaceVest, Techno Venture Management and New Vantage Group.

Through a series of presentations, students explored a number of topics such as determining if technology is in their future; converting an idea into a real business; building the right business team; reviewing intellectual property and licensing; and presenting ideas through the perfect business plan and the "30-second elevator pitch."

Jonathan Aberman, a principal with the law firm of Fish and Richard, PC, has participated in two boot camps. "This year, there was a greater sense of optimism about the economy even though students have a greater awareness that if you stick your head out, it will not necessarily be a safe fall," he relates. "The passion for innovative thinking continues to be strong."

Aberman views the boot camp as a good way for students to see how concepts are applied to the real world. "The university should be commended for offering the boot camp," he adds. "It is indicative of the thinking occurring on campus about developing technology." He cites the university's commitment to developing a technology cluster. "You can't have successful technology entrepre-

Continued on next page

Mechanical engineering major and former Maryland crew member Eric Jones is developing feedback training data devices based on GPS technology.

Borna Ghavam, a sophomore electrical engineering major, right, reviews ideas with business partner Sam Rastin.

neurship without the overlay of physical infrastructure, a world class research institution, a strong workforce and a sophisticated service provider community such as lawyers and finance experts," explains Aberman. "Together, we can generate an explosion of technology companies."

Innovation is in the genes for Eric Jones, a junior mechanical engineering major, whose father obtained a patent years ago for an innovative drafting tool called the See-Square. Aptly named, the device draws angles using optical properties of prisms. In the course of discussing the patent with fellow students, Jones learned of the Hinman CEOs program and applied in the spring of his freshman year.

He, too, has participated in the boot camp for the last two years. "In addition to giving me some new ideas, the boot camp hooked me up with all the resources I need as I think about launching my own business," notes Jones.

When he joined the university's rowing team last year, Jones saw an opportunity to use global positioning systems to develop training devices for crew and other mobile sports such as skiing and water sports. His proposal to the NCIIA resulted in start-up funds for his product team, which reached the semi-finals in the university's business plan competition and recently won top honors in the undergraduate business plan competition in the Smith School.

"A major part of participating in the Hinman program is looking forward to starting your own company or being a part of a small company in which you can do more than traditional engineering," says Borna Ghavam, a sophomore electrical engineering major.

Ghavam is melding his newly acquired business knowledge with his technology interests to launch a print media firm, 57th Avenue Advertising. With a professional web developer, Ghavam is developing a series of print digests that will highlight specific lines of business in a given region, such as a health guide using advertising by local health service providers, or a menu digest, advertising menus from local restaurants. Accompanying web sites will be developed.

"I found the marketing presentations to be particularly helpful," explains Ghavam, who was reminded of the importance of telling the customer what they want and need to hear rather than telling them what entrepreneurs think is important.

It is not just the technical expertise offered through the boot camp that students find beneficial, but the vote of confidence they gain for their own abilities. "At the boot camp, you are surrounded by successful entrepreneurs and it makes you feel that if you play your cards carefully, you could be successful," adds Ghavam. "You definitely feel motivated, energized and confident that you can do it too." ■

Fischell Receives Innovation in Technology Award

The 14th annual *Discover Magazine* Awards for Innovation in Space Science and Technology named engineering professor of the practice and alumnus Robert Fischell as one of six revolutionaries who changed the world. The magazine cited Fischell as an inventor who saved 65,000 lives through one of his innovations—the implantable cardiac defibrillator.

Fischell's career includes his experience as an engineer and scientist in the private and government sectors, first at Johns Hopkins University Applied Physics Laboratory in space technology. Later, his career interests shifted to applying space technology to enhance the quality of life through the development of novel medical devices.

A prolific inventor with nearly 200 U.S. and international patents, his work has resulted in a large variety of medical device improvements and new technologies, including the first implantable insulin pump, the rechargeable pacemaker and stents for placement in coronary arteries.

Today, he is chairman of Fischell Biomedical, LLC and Angel Medical Systems, Inc., and serves as a professor of the practice in the Clark School's mechanical engineering department. In addition, he is a member of the Clark School Board of Visitors and trustee of the University of Maryland, College Park Foundation.

Fischell was awarded an honorary doctoral degree from the University of Maryland in 1996, and received a M.S. in physics from the university in 1953. He was awarded a B.S. in mechanical engineering from Duke University in 1951. Fischell is a member of the National Academy of Engineering and has received numerous awards and recognitions including induction into the Space Technology Hall of Fame, the University of Maryland's 2001 Major F. Riddick Jr. Entrepreneurship Award and the Clark School's Innovation Hall of Fame 2002 Award.

In 2001, Fischell established the Fischell Fellowship in Biomedical Engineering that provides a graduate student at the Clark School with the opportunity to produce new medical systems and devices. ■

Robotics Racing Team Shift Gears

Michael Armani, a junior mechanical engineering student, has always been up for a challenge. His research experience at the Clark School has armed him with the basic skills, including data collection and analysis and algorithm development, to tackle one of his latest projects—the DARPA (Defense Advanced Research Projects Agency) Grand Challenge Contest.

The DARPA Grand Challenge (DGC) is an autonomous robotic race, which requires off-road vehicles to travel 300 miles of California terrain, mainly the Mojave Desert, in under 10 hours without human intervention. The challenge is part of a congressionally-mandated program to facilitate robotic development and to make one third of the U.S. military ground forces autonomous, or computer driven, by 2015.

After learning of the challenge from a friend, Armani single-handedly drafted a 10-page proposal to DARPA in early fall for the event, which is open to virtually any non-government employee from students to renowned robotics researchers. From 80 papers received by DARPA, 45 papers and respective authors, including Armani, were selected as potential participants to vie for the challenge's $1 million prize. While Armani was not selected to advance to the final competition this year, he enjoyed the experience and has his eyes on the prize for the 2005 DGC.

"I competed in the challenge with major players in the field of robotics," says Armani. "I entered the challenge because my skills fit, I liked the project and I liked finding sponsorship." A number of small companies provided support to Armani's efforts, including software, computer assistance, and a global positioning system (GPS). The Clark School of Engineering also provided funding for the project.

His team includes fellow mechanical engineering majors Chris Eliot and Mark Chambers, computer science major Jason Lettman and Bernie LaFrance, machinist of the J. M. Patterson Machine Shop. Sami Ainane, director of undergraduate programs, has served as advisor for the team, which plans to race in the International Robotic Racing Federation competition in September 2004 for a similar $1 million prize.

The Team Armani vehicle will cost less than $25,000 and its success will rely on a complex algorithm that allows the all-terrain vehicle (ATV) to detect obstacles on camera. The distance-to-object information and bearing-to-object information will be gleaned through one camera aboard the ATV and processed by the GPS. Armani hopes to seek a patent for his new camera technology in the months to come.

"Our team was the second youngest in the DARPA competition and I view this as a great way to build credibility for future research," says Armani, who can frequently be spotted tooling around campus on his custom-built, motorized mountain bike. ■

Junior mechanical engineering major Michael Armani, pictured on his customized mountain bike, developed an autonomous robotic racing vehicle that he hopes to enter in an upcoming national competition.

Scholarship Aids Bio Resources Major

A strong achiever in math and science, Brisca Lee knew during her high school days that she wanted to be an engineer. Her difficulty was selecting a discipline, until an interest in biomedical engineering was sparked during an open house at a local university. Shortly thereafter, Lee met the faculty in the Clark School's bioengineering program and felt right at home, quickly making her decision to enroll in Maryland's engineering program. "I really like helping people," says Lee. "And with my skills in science and technology, I can help patients through the development of some new technologies and new medical devices."

A 2002 graduate of Watkins High School in Montgomery County, Maryland, Lee currently holds a 3.95 grade point average as a biological resources engineering major. Her excellent academic record combined with a demonstrated need for financial assistance made Lee the perfect candidate to receive the Engineering Alumni Centennial Scholarship this fall. The endowed scholarship was established during the 100-year celebration of the engineering school by alumni who wanted to make higher education opportunities available for future engineering students.

Brisca Lee is interested in using her engineering background to develop innovative medical devices.

The oldest of three children, Lee knows how difficult it is for families to finance higher education when a number of siblings are attending college at the same time. "This scholarship is a big help to my family and I am grateful," says Lee. "Any financial assistance makes a big difference for us."

The scholarship will enable Lee to continue her engineering education, which began even before she formally entered the Clark School.

While still in high school she was selected for a summer internship at the NASA Goddard Space Flight Center. Lee worked closely with an alumnus of the University of Maryland tracking the movement of satellites in orbit and processing the data, which is generated 24 hours a day, seven days a week.

During the summer before her freshman year, Lee participated in the Clark School's Research Internships in Science and Engineering (RISE), an intensive summer program that teams female faculty mentors from the Clark School with students. During a RISE symposium, Lee heard Cori Lathan, president and chief executive officer of AnthroTronix, describe her firm's creation of robotic technology to help children increase their physical mobility, literacy skills and independence. AnthroTronix is

Help Students Achieve Their Goals

Scholarships, funded by alumni and friends of the Clark School, truly make a difference in the lives of our students. These funds represent a critical source of financial aid that allows young talented men and women to achieve their educational ambitions.

For the current academic year, one-third of Clark School students qualify for financial assistance. Students receive funding directly from the engineering school or from university-wide or outside sources in the form of scholarships, loans or grants. While 597 students are receiving about $1 million in scholarship aid from the Clark School, many engineering students still need financial assistance, totaling some $4 million.

Outside funding, including federal or state aid, cannot keep pace with the financial requirements of students attending colleges and universities today. "Private contributions, such as giving to the annual fund or establishing an endowed scholarship, will help us close that $4 million gap in providing financial assistance to our students," says Dennis McClellan, assistant dean for external relations for the Clark School. "A gift to support student scholarships is a significant and meaningful way to invest in the next generation of engineers," he adds.

To learn more about giving to scholarships, please visit our website: www.eng.umd.edu/giving. ■

supported through the Clark School's Technology Advancement Program (TAP). "The minute she started speaking I felt it was exactly like something I would want to do," says Lee, who talked with Lathan after her speech and received even more inspiration. Besides boosting her confidence, RISE also gave Lee the advantage of knowing her way around campus when she arrived for her first semester.

Just finishing her sophomore year, Lee has already participated in a number of research projects. One of her more memorable experiences was working with researchers at the National Cancer Institute to analyze gene expressions. "The researcher I worked with really cared about me learning," says Lee. "It was my first lab experience outside the university and it gave me the chance to meet and interact with students who were about to enter medical school."

When Lee was invited to participate in Gemstone, an invitation-only program for top-performing students across the university, she jumped at the opportunity. Her team is undertaking a three-year research project investigating the efficiency of vaccine administration in Third World countries. "Many vaccines are not transported or used properly and millions of people die because they don't have access to them," says Lee. Needles that are used more than once and vaccines that are improperly diluted, either through carelessness or poor training, contribute to the problem. "One of our goals is to find a region of the world where we can establish a program in which vaccines can be administered more effectively," offers Lee, who notes the team may initially implement a program in the local area. "It will be interesting to see how our project evolves over the next three years."

If you would like to contribute to the Engineering Alumni Centennial Scholarship Endowment, please contact Cornelia Kennedy, director of alumni affairs, at ckennedy@terpalum.umd.edu *or 301.405.2150. Contributions to the fund can be made to the A. James Clark School of Engineering, Engineering Alumni Chapter, 1131F Glenn L. Martin Hall, University of Maryland, College Park, MD 20742.* ■

Your Support Makes a Difference

Alumni participation rates are indicative of a vibrant university, in which alumni cast a vote of confidence in the school that gave them a good education. It is perhaps the reason why *U.S. News and World Report* uses alumni participation in its evaluation and ranking of the top universities in the nation. When you give back to the university, or to the school or college from which you graduated, you demonstrate your commitment and investment in its future.

While the Clark School is highly regarded, particularly by its graduates, it is outperformed by many of its peer institutions in alumni giving. This information resulted in establishing an Annual Giving Leadership Task Force to invigorate the school's giving program. Members of the task force are working with fellow graduates to boost participation in giving and to generate renewed interest and commitment to the Clark School.

YOUR GIFT DIRECTLY BENEFITS THE ENGINEERING PROGRAM

- Your financial support plays a positive and meaningful role in supporting educational opportunities for future engineers through the funding of scholarships, student competitions, and facility and equipment upgrades.
- *U.S. News & World Report* uses the alumni giving participation rates as an indicator of alumni satisfaction in its annual rankings of colleges and universities. Your gift validates your approval of the university, the quality of your education, and value of your degree.
- The Clark School regularly applies for grants and other funding from corporations and foundations that often require the alumni giving participation rates as part of their application criteria. Your gift can help leverage significant research funding.

EVERY GIFT COUNTS

Last year, only five percent of engineering alumni contributed to the annual fund, down from 7.5 percent the previous year. To reverse these statistics, every graduate is urged to make a gift to the engineering annual fund. Since alumni participation is measured on how many alumni give, not just on how much they give, each gift counts toward the participation rate—whether it is $5, $25, $100 or $10,000.

Over the next three years, your commitment and generosity can help us reach our goal of raising the participation rate to 10 percent. Your interest and support truly makes a difference in the lives of our students and faculty and by ensuring that the Clark School will continue its tradition of excellence in engineering education and research.

To make a secure, online gift, or to learn more about other methods for making a gift, visit our giving website at www.eng.umd.edu/giving, or contact Radka Zach, assistant director of development, at radka@umd.edu or 301.405.8072. ■

Connect with Classmates

In 2001, Robert Cerbone, ’95, ’01, began a new job with the Telecommunications Development Fund in Washington, DC, one that required him to identify new companies with emerging technologies in the communications area.

“I needed to build relationships and tap into existing networks to find bright engineers with good ideas,” recalls Cerbone. His search for promising start-ups led him back to his alma mater. Today, as president of the Engineering Chapter of the Alumni Association, Cerbone is leading the charge to expand chapter offerings and student and alumni involvement.

“The chapter is interested in building the engineering family,” offers Cerbone. “We are focusing our efforts on re-engaging graduates with the school. We’ve been particularly successful in coordinating with events or functions where we know a large number of Maryland engineers will be attending.”

At a Clark School-sponsored reception last year, Norine Walker, ‘83, met Cornelia Kennedy, director of alumni affairs. Within months, Walker, a project manager for Potomac Crossings Consultants, a joint venture of three engineering firms managing the Wilson Bridge’s design and construction, was hosting student tours of the project site. At the suggestion of a fellow graduate, she joined the Engineering Alumni Chapter board and now works on outreach efforts to students and local businesses.

Cerbone, who has also lectured and mentored students in the Hinman CEOs (Campus Entrepreneurship Opportunities) program, adds that the board is eager to build closer bonds with current students. “The school is full of interesting students with brilliant technical minds. There are so many ways alumni can help in the learning process and in preparing students for their careers,” he confirms.

“The Clark School is such a strong influence in the engineering community and there are so many positive signs in terms of the quality of programs and resources available,” says Walker. “You don’t realize how easy it is to give back to the school until you talk with staff and share your experiences.”

A variety of chapter committees enable graduates to match their interests with volunteer opportunities. The chapter promotes the engineering profession through activities such as National Engineers Week and the Order of the Engineer ceremony and encourages support for scholarship and awards (see related story, p. 18). Board members also select the annual Distinguished Engineering Alumnus candidate, who is honored at the university-wide Alumni Association Awards Gala. This spring, the chapter will sponsor its first golf outing and coordinate activities with the university’s Maryland Day celebration in April. “Even if you have only a few hours a year to give back to the engineering school, we can find a project that is right for you,” encourages Cerbone.

Paul Fagiolo, ’93, certainly agrees. Fagiolo has served on the engineering alumni chapter board for three years, most recently as treasurer. “As a native to the College Park area, the university has been a touchstone for me throughout my entire life,” he admits. “The professional resources available at the Clark School help me stay on the cutting edge of my craft. Most students graduate, leave the university and forget about all of the resources here.”

“Through board and alumni activities, there are plenty of opportunities to network,” he adds. “So many alumni are returning wide-eyed about what the school of engineering now has to offer.”

To learn more about upcoming activities and how to join the Engineering Alumni Chapter, visit the web site at www.eng.umd.edu/alumni or contact Cornelia Kennedy, director of alumni affairs, at ckennedy@terpalum.umd.edu, 301.405.2150. ■

2003 – 2004 Engineering Alumni Chapter Board of Directors. Front row left to right, Charles Warburton, Cornelia Kennedy, Rob Cerbone, Frank Cirillo. 2nd row Left to right, Norine Walker, Hank Doyle, Tim Gipe, Catherine Buxton, Ralph Wheeler. Back row left to right, Eric Gwin, Kurt Keydel, Paul Fagiolo, Gregg Wollard.

PHOTO BY LUISA DIPIETRO

ENGINEERING THE FUTURE

Forward Thinking

Charles Alfred (Al) Shreeve and Elsie Starks met in 1937 in Far Rockaway, New York, where they both belonged to a singing group, a popular activity in those years. Elsie, who graduated from Cornell University, was working for a Wall Street brokerage firm and Al had moved to New York to work for the engineering firm of Babcock and Wilcox. They married three years later. "We shared a love of the sea, and so we took a schooner sailing trip to Hawaii that summer. Not the typical honeymoon but a lot of fun," Elsie recalls.

Their wedding trip was a pivotal point in the direction Al's career would take. In order to take the summer off, Al switched jobs. He took an instructor's position at Pratt Institute in Brooklyn. He recalled that one of his favorite professors and mentor successfully combined teaching and consulting and he thought he would do the same. "Whereas consulting will always allow me to apply practical applications of mechanical engineering, teaching will allow me to pass this knowledge on," Al once told Elsie.

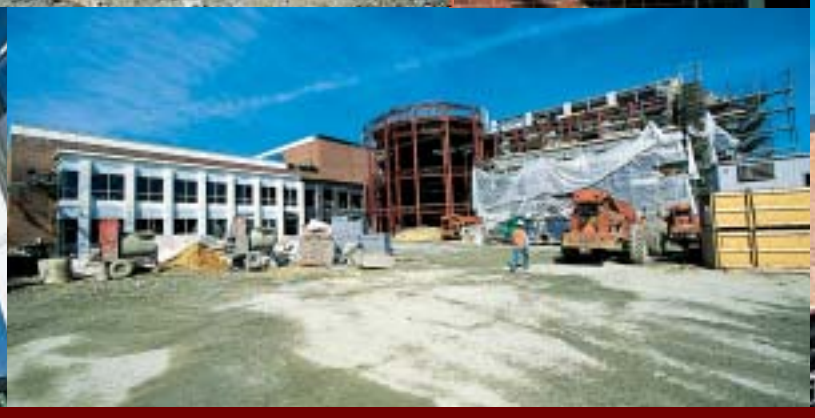
Eager to return to the Baltimore area, Al secured an assistant professor position at the University of Maryland in 1941, where he also pursued his master's degree and doctorate in mechanical engineering. All were important steps for more progressive responsibility at the university. By 1959, he became head of the mechanical engineering department and remained in the position until 1970, when he returned to teaching for twenty-one more years. Throughout his university career, he continued his consulting work for a number of national and regional companies and government agencies, until retiring in 1991.

Al combined his interest in real estate with his devotion to students. Early in his career, he bought an off-campus apartment building and rented it to his students, many from India and Pakistan, who were often dinner guests in his home. "This proved to be a rewarding learning experience for everyone, including our growing family of three boys," Elsie explains. The Shreeves also bought a farm in Howard County, which the family used as a recreation retreat. Later, with a group of friends who became investors, they bought a plantation house built in 1700 at Shipping Creek on Kent Island. "With 250 acres, and a beautiful lawn, it proved to be a great place for department picnics, crab feasts and fun times," Elsie explained on Al's behalf. Following a stroke a few years ago, Al has resided in the Asbury Nursing Home in Gaithersburg, Maryland, close enough for daily visits with Elsie, which sustains their 63-year marriage.

In addition to his success as an engineer, professor, landlord, and devoted husband and father, Al has a heart for philanthropy. As he prospered, he directed funds to a number of causes, including the support of people of Appalachia and to ambitious students working towards their educational dreams. "Al set up this undergraduate scholarship at Maryland, giving what he could over time, originally without my knowledge of his kindness," notes Elsie. "In honor of his generosity and his love for education, I've contributed additional funds through charitable gift annuities to enhance the Charles A. and Elsie Shreeve Scholarship fund." Through this planned gift, one daughter of each of Al's brothers will receive monthly funds, and upon their death, the funds will revert to the university. "It's a win-win for everyone," she adds. ■

TO LEARN MORE ABOUT GIFT ANNUITIES OR FOR CONFIDENTIAL INQUIRIES ABOUT OTHER PLANNED GIVING ARRANGEMENTS, PLEASE CALL OR WRITE:

Nelson Marban, Director of Development, Clark School of Engineering, University of Maryland, College Park, Maryland 20742 ■ 301.405.8289 ■ ngmarban@eng.umd.edu



PHOTOS BY JOHN T. CONSOLI

The construction of the Jeong H. Kim Engineering Building—one of the most advanced engineering facilities in the nation—is rapidly progressing toward a completion date of January 2005. The building is 55 percent complete and starting to look finished with most of the elements of the façade in place. While generous individuals and corporations have already named many of the labs and classrooms, additional naming opportunities are still available for research and instructional laboratories, classrooms, and meeting spaces. Please contact Dennis McClellan, assistant dean for external relations, at 301.405.0317 for more information.

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