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E@M

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More Voices, More Choices

CLARK SCHOOL RESEARCH BRINGS NEW COMMUNICATIONS CAPABILITIES TO PEOPLE AROUND THE WORLD

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THE UNIVERSITY OF MARYLAND

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Dear Alumni and Friends:

I'D LIKE TO INTRODUCE—or for some of you, re-introduce—Dr. Marilyn Berman Pollans, an exceptional friend to the Clark School of Engineering.

Marilyn began working for the Clark School in 1971, first as counselor, then, over the course of 25 years of service, as assistant and associate dean. She retired in 1996, but joined the Clark School's Board of Visitors in 1998 and continues to provide invaluable service and advice in that capacity.

Imagine the Clark School as you would like to see it, and give to realize that vision.

Marilyn is well known for her dedication to recruiting women to the Clark School. In 1974 she started our first summer programs to introduce women to engineering. She played a key role in obtaining a grant from the Sloan Foundation to establish the Women in Engineering Program (WIE) here in 1995. She has endowed the summer program she launched and funded teaching fellowships.

Most recently, Marilyn helped to form WIE's first advisory board, joined by fellow Clark School Board of Visitors member Mary E. Lacey, B.S '78, mechanical engineering, program executive officer for the Defense Department's National Security Personnel System, and by Norine Walker, B.S. '83, civil engineering, a consulting engineer and president of the Engineering Alumni Chapter board of directors. (All three WIE advisory board members were featured in "Opening Doors for Female Engineering Students," an article in the fall 2004 issue of *E@M*.)

She also generously donated funds to establish a new "living-learning" component for WIE. Her gift will create a nurturing environment for female students, with resource-rich residential housing on a common floor in the Ellicott dorm, and do much to improve student recruitment and retention.

As we all weigh our participation in the *Great Expectations* fundraising campaign now underway (see story on page 12), I ask that you reflect on what Marilyn Berman Pollans has done, and find a way—at the level of giving that is right for you—to do the same: stop and imagine the Clark School as you would like to see it, and give to realize that vision. Like Marilyn, you can create a legacy at the Clark School of Engineering.

With warmest regards,

Nariman Farvardin
Professor and Dean

Sky Walker Program Takes Flight

PHOTO BY MIKE MORGAN

The UAV remotely controlled by Jared Grauer, B.S. '05, aerospace engineering, and M.S. '07 and Ph.D. '09, flight dynamics and control, is a precursor to the Sky Walker currently under development. The bird weighs less than one pound and has a four-foot wing span.

When James E. Hubbard, Jr., the Clark School's Langley Distinguished Professor in Residence at the National Institute of Aerospace (NIA), traveled the seas as a ship's engineer, he was inspired by the long-distance flight of the albatross. Now Hubbard has taken clues from the bird's extraordinary use of atmospheric energy to improve the flight and fuel efficiencies of unmanned aeronautical vehicles (UAVs) that could serve as communications relay and surveillance platforms.

"The gray-headed albatross routinely circumnavigates the globe during migration," Hubbard explains. "It can make a 13,000-mile trip in about 48 days, using environmental energy to increase range and performance."

JAMES E. HUBBARD, JR.

That phenomenon is the foundation for the Sky Walker Program, a 30-month project funded by the Defense Advanced Research Projects Agency involving researchers from industry, government and academia. Sky Walker is the first phase of an $11 million UAV research and development program awarded to the Clark School and NIA.

Avian-Inspired Engineering

Hubbard and his team aim to create a UAV that uses a specially developed compact laser radar system to search for convective atmospheric energy (or "thermals"). It will use this energy to gain altitude and move to the next waypoint. The UAV will harvest energy using sailplane and maneuvering techniques.

With unique wing lift and drag sensors developed at the Clark School, the UAV will optimize wing loads in flight for minimum drag and maximum lift. A thin layer of sensors that acts as a skin will enable the remote-controlled craft to feel fluctuations in wind and pressure and adjust its wings accordingly. Numerous small flaps in the wings will tailor the wing loads for minimum drag based on data collected by the sensors and instantly analyzed by an on-board computing system.

The Sky Walker Program directly supports one doctoral and one post-doctoral student from the Clark School and will give many others the opportunity to fly the models developed as part of the Sky Walker initiative. "Where else can students have access to a $1 billion laboratory at the NIA and learn to develop the software simulations and fly remote-controlled vehicles?" Hubbard quips. "Students will have their fingerprints on the design of a 50-foot wing span vehicle that will take flight."

Traffic Prediction and Management Systems Combat Traffic Woes

Clark School researchers are helping to remedy commuters' daily crawl to the office. A team of faculty and staff led by Ali Haghani, civil and environmental engineering (CEE) professor and department chair, and Philip Tarnoff, director of the Clark School's Center for Advanced Transportation Technologies and CEE senior research engineer, is working with national, state and local transportation agencies to solve major road and rail transportation problems.

The group's proposal was selected for funding through a national competition sponsored by the U.S. Department of Transportation Research and Innovative Technology Administration, making Maryland one of only 10 universities in the country to earn the designation of a Tier 1 University Transportation Center. The Maryland group, to be directed by Tarnoff, will be called the Center for Integrated Transportation Systems Management.

"As urban areas become more populated, they face tremendous traffic problems," explains Haghani. "Los Angeles is one of the worst areas, but Washington, D.C., is not far behind." To address growing traffic jams and other transportation woes, the center staff will conduct research and provide the technological transfer necessary to help increase mobility and reduce congestion for travelers and shippers.

"We will be devising predictive technology and a three-dimensional transportation system display for controlling traffic as well as disseminating information to commercial shippers and travelers," says Haghani. "We are looking at ways to improve the efficiency of the nation's multimodal and multijurisdictional transportation system."

The center will receive $1 million in federal funding matched by $1 million in nonfederal funds each year for the next three years, part of which will support graduate fellowships and assistantships.

Additionally, Gang-Len Chang, professor of CEE, received a grant from the Department of Homeland Security to explore the deployment of a real-time traffic management and travel-time prediction system for the I-495 Capital Beltway, which surrounds Washington, D.C. The work includes the design of algorithms for real-time traffic simulation, incident detection, and integrated traffic control and management during emergency and special events. Chang and colleagues have already developed a similar system, in coordination with the Maryland State Highway Administration, to monitor traffic flow to and from the resort town of Ocean City, Md.

Fischell Bioengineering Addition Is Under Way

The Fischell Department of Bioengineering and the Robert E. Fischell Institute for Biomedical Devices will soon have a larger home.

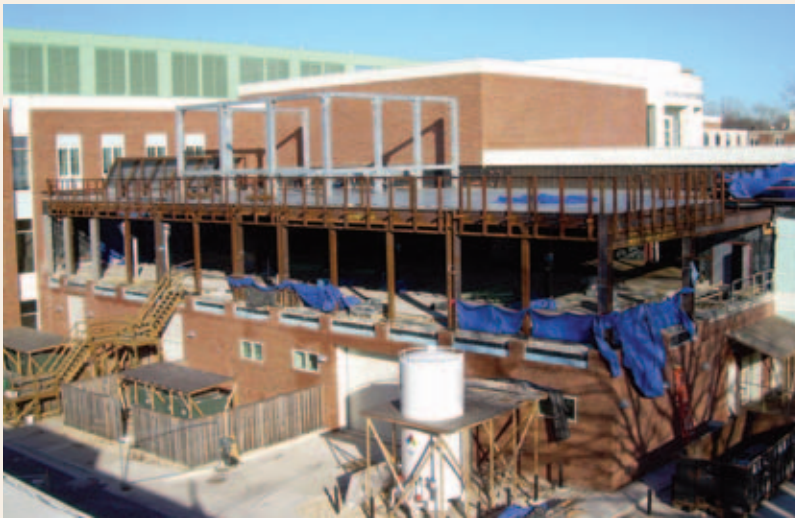
Funded through a portion of the $31 million gift from Robert E. Fischell, M.S. '53 physics, and honorary doctorate of science '96, the 7,400 square-foot, $6.1 million addition to the second floor of the Jeong H. Kim Engineering Building will include new laboratory facilities and office space for bioengineering faculty. The additional space "is absolutely pivotal in our quest to become one of the best bioengineering departments in the country," says Fischell Department of Bioengineering Chair and Herbert Rabin Distinguished Professor William E. Bentley.

"In the addition, one large laboratory space will be subdivided into bench spaces and several core equipment rooms, which will house tissue culture, microscopy, freezers and other instruments common to our research," Bentley explains. The Kim Building's "FabLab" fabrication laboratory, located directly adjacent to the new space, will physically link nanofabrication and bioengineering researchers in the Clark School for the first time. "I am looking to that synergy to accelerate the creation of new paradigms for disease discovery and treatment," says Bentley.

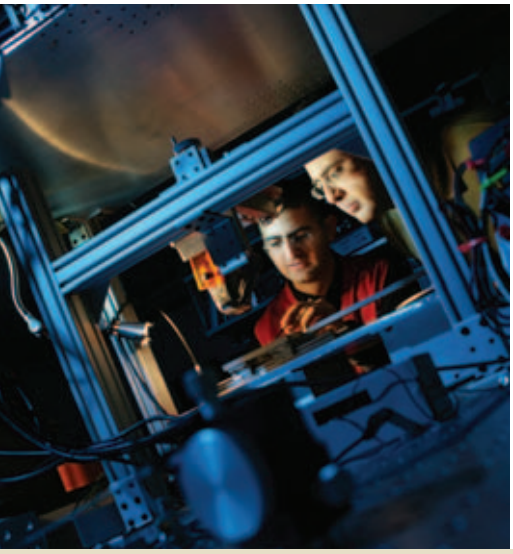
He notes that the addition, scheduled for completion this fall, will also provide office space for new faculty members in the department, which plans to add 14 new people in the next five years.

To view the construction in progress, visit www.bioe.umd.edu.

The structural steel component of the Fischell addition is now complete.



Leading the University in Energy Research



The Clark School is leading the university with the launch of the new, campuswide, multidisciplinary University of Maryland Energy Research Center. The center pursues research in areas such as fuel-cell systems, small-scale power systems for wireless electronics and propulsion systems, advanced solar energy conversion, and nuclear energy technologies. Clark School researchers will partner with colleagues in chemistry, physics, public policy, economics, and environmental studies in energy-related research initiatives. Herb Rabin, director of the Clark School's Maryland Technology Enterprise Institute and associate dean, will serve as acting director of the center. Look for more news on the center in upcoming issues of *E@M*.

Happy 50th to Fire Protection Engineering

The Clark School's Department of Fire Protection Engineering celebrated its 50th anniversary in October. Some 300 friends and alumni from all over the world celebrated the department's milestone with events that included a welcome reception, tours of new department offices, a "ribbon burning" and dedication ceremony and a formal gala.

From left, former department chairs John L. Bryan and Steven M. Spivak, with current chair Marino di Marzo, participate in the "ribbon burning."

PHOTO BY AL SANTOS

Professional Recognition

WILLIAM L. FOURNEY, professor of mechanical engineering (ME), associate dean and former chair of aerospace engineering, received the 2006 University of Maryland President's Medal, the highest honor the university community bestows. The medal recognizes a member of the College Park community who has made extraordinary contributions to the social, intellectual and cultural life of the campus.

Chemical and Biomolecular Engineering (CBE) Professor **KYU YONG CHOI** has been elected to permanent membership in the Korea Academy of Science and Technology in Seoul.

Research Scientist **IGOR SMOLYANINOV**, electrical and computer engineering (ECE), was selected by *Scientific American* magazine as a research leader in the 2006 "Scientific American 50" list for his research contributions in the emerging field of plasmonics.

MIROSLAW SKIBNIEWSKI, the A. James Clark Chair in Construction Engineering and Management and professor of civil and environmental engineering (CEE), has been awarded the title of Professor of Engineering Sciences by the president of Poland.

CEE Assistant Professor **AHMET AYDILEK** recently received two awards: the International Geosynthetics Society Award for his research contributions in the areas of "flow through porous geomedia" and image-based characterization of geosynthetics; and the American Society of Civil Engineers Collingswood Prize for his article, "Construction Size of Geotextile Filters," published in the *ASCE Journal of Geotechnical and Geoenvironmental Engineering*.

ECE Professor **RAMA CHELLAPPA**, with appointments at the University of Maryland Institute for Advanced Computer Studies and in computer science, has been selected to receive a 2006 IBM Faculty Award. A previous recipient of an IBM Faculty Development Award, he is conducting research in face recognition technology and will collaborate with IBM researchers in the area of multimodal biometrics.

ECE Professor **MARK SHAYMAN** has been named associate dean for faculty affairs in the Clark School. Previously he was associate director for education at the Institute for Systems Research (ISR) and directed the Master of Science in Systems Engineering program.

New Fellows

CBE Professor Emeritus **THOMAS MCAVOY** was elected a fellow of the International Federation of Automatic Control for contributions to process control—particularly for his pioneering work on neural network applications—and for his service as editor-in-chief of the *Journal of Process Control*.

ME Professor **REINHARD RADERMACHER** was elevated to fellow of the American Society of Heating, Refrigerating and Air-Conditioning Engineers.

Aerospace Engineering Professor **ALISON FLATAU** has been elected a fellow of the American Society of Mechanical Engineers.

Langley Distinguished Professor **JAMES E. HUBBARD, JR.** was elected associate fellow of the American Institute of Aeronautics and Astronautics.

New Faculty Bring Critical Capabilities

The Clark School welcomes the following new faculty, whose innovative ideas and capabilities will help shape the future of engineering education and whose varied affiliations will help the school build promising new partnerships.

CINZIA CIRILLO, assistant professor of civil and environmental engineering, received her Ph.D. in transportation engineering from the Polytechnic School of Engineering, Torino, Italy. A recipient of the Marie Curie Fellowship in Transportation Engineering and Applied Mathematics from the European Commission, Cirillo conducted postdoctoral research in transportation engineering and applied mathematics at the University of Namur in Belgium.

JAYDEV DESAI, associate professor of mechanical engineering (ME), was most recently director of the Program for Robotics, Intelligent Sensing and Mechatronics Laboratory at Drexel University. He holds an NSF CAREER Award for research in minimally invasive surgery using haptics and vision.

TENG LI, assistant professor of ME, was a postdoctoral fellow in the Division of Engineering and Applied Sciences at Harvard University, where he completed his Ph.D. in 2005. His research interests include the micro/nano mechanics of flexible macroelectronics.

SAMEER SHAH, assistant professor of bioengineering (BE), was a postdoctoral fellow in the Department of Cellular and Molecular Medicine at the University of California, San Diego, where he received his Ph.D. He studies neuro-muscular bioengineering at the molecular, single-cell and organ levels.

JOONIL SEOG, assistant professor of materials science and engineering, was a postdoctoral research associate at Harvard University. He received his Ph.D. in mechanical engineering from the Massachusetts Institute of Technology. He investigates the structure and function relationships of biological molecules using single-molecule force spectroscopy.

SANTIAGO SOLARES, assistant professor of ME, completed his Ph.D. in chemical engineering at the California Institute of Technology, focusing on applied computational nanotechnology. Solares was the 2002 design prize winner from the Institute for Molecular Manufacturing for the design of a fluid control nanomechanical valve.

EDO WAKS, assistant professor of electrical and computer engineering, was most recently a postdoctoral fellow at Stanford University (where he received his Ph.D.), working on nanophotonic implementations of quantum information processing. A National Science Foundation fellow, he studies the use of photonic crystals in quantum information processing and optical telecommunication and sensing.

BRUCE YU, associate professor of BE with a joint appointment at the University of Maryland School of Pharmacy in Baltimore, researches the delivery of radiopharmaceuticals and the development of peptide-based biomaterials. He received his Ph.D. in molecular biophysics from the Johns Hopkins University.

PHOTO BY AL SANTOS

Clare Booth Luce Assistant Professor Appointed

KRISTINE M. ROSFJORD joins the Clark School this spring as the Clare Booth Luce Assistant Professor in electrical and computer engineering. Most recently, she has been a postdoctoral fellow in the Quantum Nanostructures and Nanofabrication Group at the Massachusetts Institute of Technology, working on nanowire single-photon detectors.

Rosfjord received her bachelor's degree in electrical engineering from Georgia Institute of Technology and her M.S. and Ph.D. in electrical engineering and computer science from University of California, Berkeley. Her research interests include photodetectors, nanofabrication, x-rays and optical properties of materials.

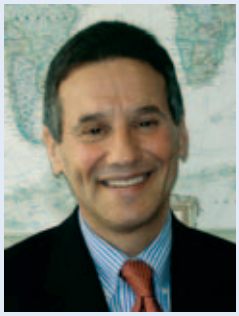
Funded by the Henry Luce Foundation, the professorship recognizes the Clark School's longstanding commitment to increasing the number of women on the faculty and building an inclusive community. The Clare Booth Luce Program is the single most significant source of private support for women in science, engineering and mathematics.

Professors of Practice

PHOTO BY AL SANTOS

MEL BERNSTEIN

MEL BERNSTEIN, university vice president of research, was named professor of practice in materials science and engineering. He will build on his extensive government and academic connections to assist the department in focusing its research efforts and creating broader partnerships. Previously, at the Department of Homeland Security, he served as acting director of the Office of Research and Development, Science and Technology Directorate, and as director of university programs in the same unit. Prior to that he served in major leadership roles at the Illinois Institute of Technology, Tufts and Brandeis.



MARVIN SAMBUR

MARVIN SAMBUR, former assistant secretary for acquisition of the U.S. Air Force, was named a professor of practice in the Institute for Systems Research (ISR). Previously responsible for all Air Force research, development and acquisition activities, Sambur now assists ISR faculty with research program development, collaborations with industry and government agencies and education program development. Earlier Sambur was president and chief executive officer of ITT Defense, responsible for managing ITT's $1.5 billion defense sector.






By Beth Panitz
Photography by Mike Morgan

More Voices, More Choices

CLARK SCHOOL RESEARCH BRINGS NEW COMMUNICATIONS CAPABILITIES TO PEOPLE AROUND THE WORLD

An astounding 219 million Americans subscribed to a cell phone service in 2006. That's 72 percent of the total U.S. population—up from 14.4 percent only 10 years earlier, according to a nonprofit organization representing the wireless industry. And that's only in one country. "We've seen an explosion of wireless penetrating our lives," notes Sennur Ulukus, an associate professor in electrical and computer engineering (ECE) and the Institute for Systems Research (ISR). "The next 10 years will bring unimaginable innovations."

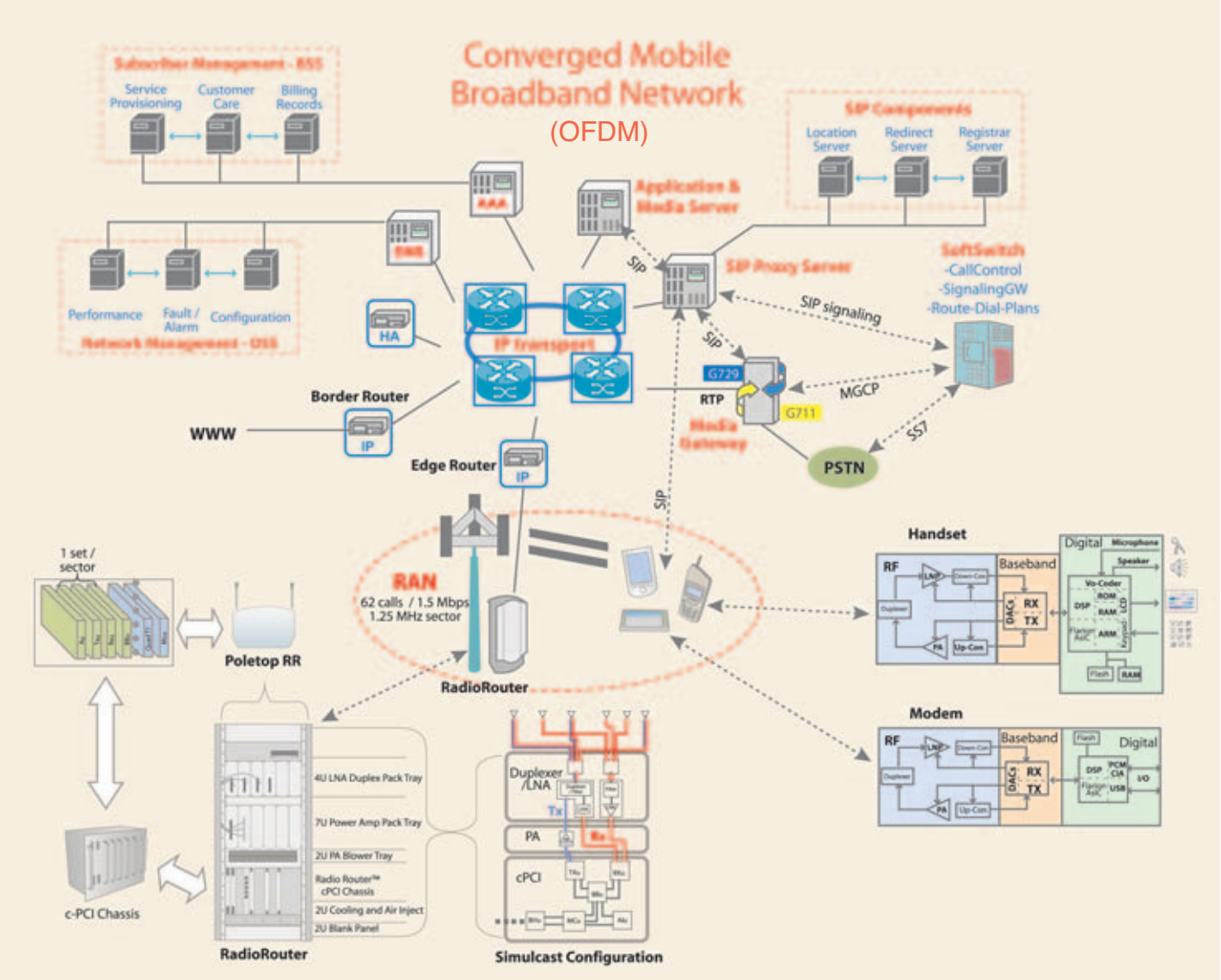
Ulukus is one of a group of Clark School researchers, advisors and corporate partners leading the wireless world forward in a number of key areas: improving the speed of, and access to, current connections, enhancing the quality and security of data communications, creating ad hoc networks that are completely wire-free and developing networks of tiny sensing computers to communicate information from remote locations. Their work will give more communications options to more people around the world than ever before, changing the way we live, work, play and relate to each other, and influencing the fortunes of businesses and nations.

The most obvious example is the cell phone—"the one device that's always with you," according to Irwin Jacobs, co-founder of wireless technology giant QUALCOMM and a recent Whiting-Turner lecturer at the Clark School. Jacobs predicts that a single cell phone will serve as a phone, watch, computer, television, personal digital assistant, wallet, global positioning system, traffic monitoring system, MP3 player and bio-sensing machine. Apple's recently announced iPhone is one more step toward that goal.

Such technologies break the boundaries between real and virtual, face-to-face and online. "Your office will be with you all the time, in any location, once you get extremely fast broadband access," says Bahram Pourmand, executive vice president for Hughes Communications and member of the Clark School Board of Visitors. Recent Whiting-Turner lecturer Kathy Hill, senior vice president, Ethernet & Wireless Technology Group, Cisco Systems, Inc., notes that mobility services are empowering new business capabilities. "Employees can do their jobs more effectively and keep track of important assets through 'presence' information provided by the wireless network," she describes. In addition, response time greatly improves when businesses have on-demand, real-time access to information and supply chains can be more tightly managed.

In these and other exciting areas of communications research, the Clark School is leading the way.

Clark School researchers, from left, Prakash Narayan, Richard La, Anthony Ephremides, Sennur Ulukus, Gang Qu and K.J. Ray Liu.



Making Cellular Faster, Clearer, More Secure

The evolution of the next generation of cellular networks, 4G, is being significantly influenced by Rajiv Laroia, M.S. '89 and Ph.D. '92, electrical engineering. (See evolution timeline, page 10.) Laroia, who was recently inducted into the Clark School Innovation Hall of Fame, has transformed the wireless world by co-inventing cellular data systems based on Orthogonal Frequency Division Multiplexing (OFDM), a technique for transmitting large amounts of digital data over a radio wave that makes broadband Internet access possible (see diagram above, related story, p. 9 and www.eng.umd.edu/ihof). Wowed by the invention, industry leader QUALCOMM acquired Laroia's company, Flarion Technologies, in 2006 for $805 million. OFDM, which sends multiple signals by using different frequencies, is the backbone for 4G technologies, such as QUALCOMM's FLASH-OFDM and the competing mobile WiMAX.

The 4G network promises to bring affordable broadband wireless capabilities to the masses, providing access to the Internet, television and high-powered video capacities through cell phones and other handheld devices. "Two technologies are about to converge—mobile telecommunications and the Internet," says Sprint Nextel's Chief Technology Officer Barry West, who spearheads his company's 4G network development. This expanded video capacity has the potential to transform our lives, West noted at the Clark School's White Symposium last fall. (See related story, p.14 or watch the symposium at www.eng.umd.edu/news/news_story.php?id=965)

Sprint Nextel's 4G network will use mobile WiMAX, a high bandwidth data-centric wireless network that will accommodate interactive multimedia applications and quadruple throughput performance. WiMAX chipsets soon will be embedded in laptops, phones and other devices, providing Internet access without the need to go to a "hot spot." "We're going to have the Internet almost everywhere and in every device you can imagine—from video cameras to gaming devices," says West. For example, your car navigation system could access the Internet to provide videos of traffic conditions.

As industry continues to search for ways to keep pace with the demand for higher speeds and increasingly visual content, Laroia remains at the forefront. OFDM's compatibility with advanced antenna technology offers a promising way to expand network capacity, he relates. Laroia is now working with multiple input/multiple output (MIMO) smart antenna technology to increase the bits of information that can be transmitted per second.

Pushing the Limits

Emerging broadband applications demand reliable wireless communication at higher transmission speeds, a problem K.J. "Ray" Liu, professor of ECE and ISR, is solving

with sophisticated methods. He developed coding techniques to maximize performance in a MIMO-OFDM wireless system. "When you receive a communication, you're actually receiving multiple signals, not just one," explains Liu. "We looked at combining signals in a constructive way. This is the only code that can achieve the maximum diversity in space, time and frequency and that means maximum performance."

Liu's groundbreaking work was honored with the university's 2005 Invention of the Year Award in the Information Science category, and he is now collaborating with Mobitrum Corporation in Silver Spring, Md., to incorporate the patent-pending invention into the company's wireless technology.

In her Clark School laboratory, Sennur Ulukus is tackling a major communications network problem: "How can we support the maximum number of people and the maximum amount of data?" One technique she is researching—power control—manages transmission power so that each wireless signal is transmitted at precisely the right strength, creating a more efficient network with less interference. She compares the technique to optimizing the number of intelligible conversations in a crowded room. "If you're talking to someone next to you, you whisper just enough to be heard. If you shout, you're going to create interference for someone else's conversation."

Another strategy—interference cancellation—helps a receiving device focus on its intended signal, canceling other signals, explains Ulukus. She has developed sophisticated power-control and interference-cancellation algorithms that could expand wireless capacity to support an ever-increasing amount of data.

Bill Witowsky, ECE Advisory Council member and chief technology officer for Texas Instruments Incorporated Systems and Software, Digital Signal Processing Systems Group, notes that "as we keep adding new features to wireless devices, we are on an innovation treadmill to reduce overall power usage. Voice calls require one level of power, but if you start watching TV or participate in video-conferencing or other activities, that requires a lot more horsepower."

"Two key components of any wireless device are the battery and the antenna," adds Tom Scholl, a general partner with Bethesda, Md.-based Novak Biddle Venture Partners and chair of the Clark School Board of Visitors. "Industry giants as well as start-ups are trying to figure out how to extend battery life and to make the antenna circuitry dynamically adaptive to the environment. If you were to ask what technology could change the mobile industry overnight, it would be in these areas," he says. "Imagine having a battery you recharge once a year instead of daily."

Playing It Safe

A pioneer in the field of wireless communications, Anthony Ephremides, professor in ECE and ISR, advocates developing an arsenal of tools to protect wireless networks from different security threats. Ephremides, who is the Cynthia Kim Eminent Professor of Information Technology, is designing anonymous routing protocols that hide routing information so eavesdroppers cannot intercept messages. The challenge, he notes, is to develop a technique to identify malicious users and prevent them from exploiting the anonymous routing capability. His research is heavily supported by the Army Research Office, which is developing secure methods to communicate top-secret military information.

His colleague Sennur Ulukus is "working on improving security at the physical layer, which actually transmits the signal through the air," by designing algorithms to minimize the capabilities of eavesdroppers and jammers who try to prevent communication. Her research involves coding the signal so that only the intended receiver can understand it and switching transmission channels to make it difficult for someone to track and jam a signal.

A new encryption technique to improve security is under development by Prakash Narayan, professor in ECE and ISR, who is exploiting connections to data compression algorithms. "When you compress data as much as possible, it looks like noise," he explains. An eavesdropper cannot make sense of this noise, while a legitimate user will have access to correlated data that will unlock the information, yielding a "secret key," which can then be used for encryption and decryption. Supplementing NSF support, industrial sponsor Interdigital Communications

PHOTO BY AL SANTOS

Laroia Joins Innovation Hall of Fame

Rajiv Laroia, M.S. '89 and Ph.D. '92, electrical engineering, is the latest inductee into the Clark School's Innovation Hall of Fame. Senior vice president of engineering for QUALCOMM Flarion Technologies, Laroia was honored for his telecommunications contributions, including the co-invention of Orthogonal Frequency Division Multiplexing (OFDM), a high-speed data transmission technique that makes broadband wireless Internet access possible. The Hall of Fame was established in 1986 to recognize individuals who have made significant contributions to society through engineering innovation.

"The real expertise in industry is systems expertise," Laroia noted in his acceptance speech, emphasizing that today's technological innovators need to coordinate complex systems. Laroia cited his experience at the Clark School's Systems Research Center (now the Institute for Systems Research) as critical to his success.

As a student, Laroia worked closely with his advisor, now Clark School Dean Nariman Farvardin. Together with ECE Professor Steven Tretter, they received a patent in 1995 for a data transmission mechanism. "There is nothing more gratifying," said Farvardin, "than to see a student like Rajiv succeed brilliantly and return to inspire Clark School students and faculty to contribute as he has to the good of society."

To learn more about the Innovation Hall of Fame, see www.eng.umd.edu/ihof.

Sennur Ulukus

Cynthia Kim Eminent Professor of Information Technology, Anthony Ephremides

Corporation is working with Narayan and Alexander Barg, professor in ECE and ISR, to incorporate this technique into a suite of algorithms for network security.

Extending Telecommunications to Everyone

For all of the wonders of today's cellular networks, these systems are still, for the most part, wired. Enter the ad hoc wireless network. "It's like a mini Internet, but truly wireless," says Ephremides. "You have many, many nodes—computers and cell phones—that work without any infrastructure."

With funding from the Department of Defense, Ephremides is hoping to make ad hoc networks perform as smoothly as those with infrastructure. "These networks are subject to interference and obstacles at every stage," he notes. "To counter those impairments, the design must be much more sophisticated." These true wireless networks could serve as tremendous military assets, allowing for instant communication networks in the remotest of areas. In the civilian world, they could link residents in rural areas to a cellular infrastructure or could be used in emergency situations if the infrastructure is destroyed, adds Ephremides.

Finding the Fastest Route on the Network Highway

Routing a message in this completely wireless environment is challenging, says Richard La, an assistant professor in ECE and ISR, who is developing more efficient routing protocols. With NSF funding, he designed an algorithm to find the most stable multi-hop path between two points, ensuring that data gets to its destination reliably. Finding the best path gets complicated in a network with moving nodes that might suddenly be out of transmission range, creating what compares to an unexpected road closure.

In simulation tests, La's algorithm yielded a 40 to 60 percent increase in the duration of workable paths. The results are even better when combined with a "local recovery algorithm" he developed that creates a detour when a link in the path becomes unavailable, similar to an alternate path a detoured driver may choose.

La, along with Ephremides and Ulukus, is also refining media access control (MAC) protocols, the rules that determine when each transmitter in a network can access a shared channel. "Designing an efficient MAC protocol is crucial for improving the throughput of a mobile ad hoc network," explains La.

Additionally Ephremides is exploring a new technique called network coding that could substantially increase network throughput. Network coding offers the possibility of more throughput by combining, or "carpooling," messages that currently travel on their own networks. For example, when two messages arrive at a node from different sources, they would be combined into one packet.

With funding from the U.S. Army Research Laboratory and the Office of Naval Research, Ephremides's team is the first to study this breakthrough idea in the wireless environment. "No one would have anticipated that garbling packets together would improve performance," says Ephremides, who is searching for efficient ways to separate the packet information to ensure that the correct data reaches each destination.

Tying Transmission Techniques

Prakash Narayan is investigating the possibility of a hybrid communication system that optimizes performance in wireless ad hoc networks by drawing on the best of two current communication techniques—radio frequency (RF) transmission and optical beaming. Though commonly used, RF transmission is plagued with interference problems. Optical beaming offers higher speeds and less interference, but the optical beam fades as it travels through the air due to turbulence.

Cellular Service Evolves

1980s: 1G, Analog Cellular Service for Voice Only
Mobile phone users can carry conversations seamlessly as they move from cell to cell. A digital system is launched in Europe for voice only.

1990s: 2G, Digital Cellular Service with Limited Data
Digital transmissions allow for more phone conversations in the same amount of spectrum and lay the groundwork for services beyond simple voice telephone calls.

2000 to present: 3G, Broadband Cellular Service
Broadband capabilities provide the ability to transfer simultaneously both voice data and non-voice data, including limited Internet access.

Anticipated 2008: 4G, High-speed Broadband Service
These speeds enable high-quality, real-time video transmission and rapid download of large music files.

From left, K.J. Ray Liu discusses research with Gang Qu and Prakash Narayan.

Richard La

"There are pros and cons to each," says Narayan. With NSF funding, "we are developing a hybrid system that would know when to use each method." When a signal is sent to the receiver, it would send feedback to the transmitter to help it select the appropriate option. The technology could be used in ad hoc networks, such as robots manufacturing car components. The robots could communicate with each other in harsh industrial environments—switching seamlessly between RF and optical beaming to exchange information. In crowded urban areas with plenty of RF congestion, optical beaming between rooftops could provide an alternate transmission method.

Transmitting Opportunities and Dangers

Imagine thousands of sensors throughout a subway system, each device quietly monitoring for a chemical terrorist attack. Through a wireless network, these sensors alert security personnel to the presence of dangerous chemicals.

Ephremides and a multidisciplinary team of Clark School researchers are busy refining sensor networks that may one day become a prevalent way of collecting data on everything from terrorist threats to temperatures. Wireless sensor networks operate like ad hoc networks, with data traveling in many hops from node to node to its final destination, explains Ephremides. A sensor network could be deployed in the ocean to monitor pollution levels, in a battlefield to detect troop movement or in a forest to identify fires. Based on collected data, sensor networks could trigger actuators to respond appropriately, from a simple security system that detects movement and triggers lights to a sophisticated command-and-control military system.

The energy issue is crucial in sensor networks where sensor nodes are difficult to retrieve and recharge. "If you put sensor nodes in the enemy's battlefield, you can't go back and replace the batteries," notes Gang Qu, an associate professor of ECE. "When the battery dies, so does the sensor. As more sensors die, the network eventually becomes inoperable."

At the Clark School's new wireless sensor lab, filled with off-the-shelf sensors and computers, researchers are improving energy efficiency in everything from hardware to network protocol design, says Qu. The team is exploring trade-offs between a node's three main energy-consuming functions: data collection, data processing and data transmission. For example, a network might exert minimal energy in data processing, but consequently require more energy to transmit the overwhelming amount of raw data. Qu emphasizes the importance of tackling the energy issue from a systems approach, noting that "a sensor network is like a small community, and together the sensors complete the task."

Jeong Kim, president of Bell Labs and a professor of practice in the Clark School, speaks to the future significance of sensor networks, noting that Bell Labs is already producing sensors with a wireless range of one-half of a kilometer and a target weight of only 35 grams (about the weight of six U.S. quarters). He fully expects that future sensors may be as small as grains of sand. "Sensor networks will generate a huge volume of information," he says, pointing to the radio frequency identification (RFID) sensor network already being used by retail giant Wal-Mart to track inventory. "Down the road, don't be surprised if there are radio frequency implants in children for identification purposes that may offer an improvement over the fingerprinting ID programs that are popular today."

A Powerful Voice

The wireless revolution promises to offer more people more ways to access and send unprecedented amounts of non-voice and voice data and visuals, anywhere, anytime. While the technology can provide wonderful opportunities, it's yet to be seen whether the changes will all be for the good, says Barry West, who questions if literacy will decrease as access to visual-centric media increases. "Why will we even bother to learn to read and write?" he questions.

Others are more optimistic. Hughes's Pourmand sees wireless technology opening a sea of information—written, verbal and visual—to people in developing countries lacking wired infrastructure. "You make it possible to provide education to way more people, increasing their standard of living."

Matt Kirschenbaum, associate director of the university's Maryland Institute for Technology in the Humanities, is confident that these new technologies will only enhance communication at every level. "Current wireless technologies rely heavily on language with e-mail, chat rooms, texting," he notes. "The powerful, creative combination of words and images will demand even higher levels of thinking from users."

Beth Panitz is a freelance writer based in Rockville, Md. A graduate of the University of Maryland College of Journalism, she previously served as senior editor of ASEE Prism, *the magazine of the American Society for Engineering Education.*

GREAT EXPECTATIONS
THE CAMPAIGN for MARYLAND

Clark School Targets Top Priorities In *Great Expectations*

PHOTOS BY MIKE MORGAN AND JOHN CONSOLI

Campaign priorities include (left to right) graduate fellowships, distance education facilities, the Keystone program and the University of Maryland Energy Research Center.

The plan for *Great Expectations: The Campaign for Maryland* calls for the Clark School to raise $185 million of the total $1 billion university goal—the largest portion to be provided by any school within the university. This is an ambitious target, one that is crucial to the school's continued progress toward the ranks of the nation's top five public engineering programs. The fact that the school has already raised more than half of its portion is a very positive sign, but the school must elicit many significant gifts, from a broader range of donors than ever before, if it is to reach its total objective.

Much of the credit for the school's campaign success to date goes to two Clark School contributors who serve as co-chairs for the *Great Expectations* campaign: A. James Clark, B.S. '50, civil engineering, and honorary doctorate of science, '92; and Robert Fischell, M.S. '53, physics, and honorary doctorate of science, '96. Through the largest gifts in the school's history, Clark created the A. James Clark Scholarship Endowment for Undergraduates, and Fischell and his sons established the Fischell Department of Bioengineering and Robert E. Fischell Institute for Biomedical Devices.

"We are extremely grateful to these visionary donors, whose support is already adding to the strength of our programs," says Clark School Dean Nariman Farvardin. "Such support is critical if we are to continue to produce the significant technological, educational and entrepreneurial innovations of which we are capable and approach the financial support received by other leading public schools."

Competitive Priorities

Through creativity and hard work, the Clark School has achieved successes well beyond the level its financial resources would predict, and begun to achieve the recognition of its peers. In pursuing its $185 million campaign goal, the Clark School seeks to double its current endowment of $105 million and make its resources more closely match its capabilities and ambitions. Within the $185 million goal, a number of key priority areas have been identified.

- **The Clark School's campaign goal for undergraduate and graduate student support is $75 million.** The $30 million Clark Scholarship Endowment is already enabling the school to attract its strongest freshman class in terms of class size, academic quality and an especially large contingent of women students. Now, the Clark School is focusing on increasing its graduate fellowship endowment, which is currently less than 10 percent of the mean graduate fellowship endowment of the top five public engineering schools.
- **A goal of $50 million has been set for new programs.** The effort was kicked off by the $31 million gift to fund the Fischell Department of Bioengineering and the Robert E. Fischell Institute for Biomedical Devices. Building on current strengths, the school seeks to create a new Center for Technology Entrepreneurship, a new Engineering Student Services Center and other important programs, and fund a new cross-disciplinary Energy Research Center.

- **The campaign goal for faculty development, recruitment and retention is $40 million.** With this increased funding, the school will create new professorships to double its cohort of nationally recognized faculty members (the school currently attracts leading professors at only 30 percent of the levels achieved by the top five public schools), offer financial support to retain existing faculty and reward faculty achievement in research and teaching, and support the new Keystone program, which encourages our best faculty to teach our most fundamental courses.
- **An additional $20 million goal has been established for facilities, renovation and equipment.** While the Kim Building is already expanding to accommodate the Fischell Department of Bioengineering, the school plans to build a large, stand-alone bioengineering facility in anticipation of the field's rapid growth. Funding will also create a new facility to centralize and consolidate now-dispersed distance education functions, modernize computer, video and communications technologies for greater capability, flexibility and growth potential and offer meeting space and services for faculty and students.

Recent Significant Gifts Boost Campaign Efforts

Marguerite and Patrick Sung have pledged $1.5 million to the Clark School for two endowed professorships in chemical engineering (see related story below).

The Robert W. Deutsch Foundation is giving the Clark School more than $1 million over four years to advance nano-biotechnology research.

The $1.7 million gift from the David H. and Suzanne D. Hillman Family Foundation supports an innovative program to foster entrepreneurship in Washington-area communities (see related story, p. 16).

Joyce and Erik Young have made a $250,000 gift to endow a faculty fellowship in aerospace engineering in honor of Erik's father, Willis H. Young, Jr.

To learn more about the* Great Expectations *campaign, please contact the Clark School Office of External Relations at 301-405-0317 or support-theclarkschool@umd.edu.

Reconnecting with the Clark School

T.K. "Patrick" and Marguerite Sung

The year was 1988 and Marguerite Sung, B.S., '70, mathematics, a computer programmer, and her husband T. K. "Patrick" Sung, M.S. '69 and Ph.D. '72 in chemical engineering, a successful intellectual property lawyer, were at a crossroads.

Marguerite's employer, US Airways, was relocating to North Carolina, forcing the couple to consider a family move. "I had worked for US Airways for 16 years," she recalls, but happy with the Potomac area and looking for a new house there, the Sungs wanted to stay put. She says, "I was thinking of selling real estate when our children's karate instructor suggested part-time work in a company he just joined."

Marguerite soon started with Nu Skin Enterprises, Inc., a global direct-selling company of premium quality personal care products in more than 40 markets throughout Asia, the Americas and Europe. After just three months selling products to friends and acquaintances, she realized the potential income she could earn. The business expanded beyond their wildest dreams, and Patrick retired from law in 1996 to join Marguerite in the venture.

Today, they share their success with the university through a number of generous gifts. The Sungs have pledged $1.5 million to the Clark School for two endowed professorships in chemical engineering and $500,000 to the College of Computer, Mathematical and Physical Sciences to establish an endowed graduate research fellowship in mathematics.

"This is the place that gave us our start, so what better way to show our gratitude," says Patrick.

The Sungs, who were both born in China, say they hope their gift will start a trend that other Asian-born graduates will follow. They recently traveled to Taiwan with university officials as College Park ambassadors to discuss partnership and giving opportunities with friends of the university.

"University's Progress is Amazing"

The couple met at College Park, which holds a special place in their hearts. "We share the same good feelings about Maryland. The campus was the setting for the first experiences of our adult lives in America," says Marguerite, who came to the United States with her family in 1965. "It makes it even more worthwhile to see the high quality of programs at Maryland."

Accepted in the civil engineering program at Maryland, Marguerite changed her major to mathematics at the suggestion of a family member. A Cobol programming course taken in her last semester led her to pursue a career in computer programming.

Patrick Sung left China at age 17 to pursue a bachelor's degree in chemical engineering at the University of Tulsa in Oklahoma. With no family and few friends in the United States, Sung chose Tulsa because a high school friend attended school there. He later attended Maryland on scholarship to pursue his master and doctoral degrees in engineering.

"I remember the dark labs of my graduate school days and I look at the Kim Building today. Wow, what a difference!" says Patrick. "We are enjoying campus again, and have attended football and basketball games and seen all of the new buildings. The university's progress is amazing."

Attracting Experts for

On any given day, somewhere in the Clark School a guest lecturer is sparking new ideas among students, faculty and visiting representatives of top companies and government agencies. Leading thinkers and technologists from venues as distinct as the Russian Research Centre and Capitol Hill are drawn by the school's reputation for groundbreaking research and the prospect of engaging renowned faculty and their students in dialogue and debate.

PHOTO BY AL SANTOS

Whiting-Turner: One of the Maryland's Premier Lecture Series

For more than a decade, senior management from large established companies and small and promising start-ups have participated in the Whiting-Turner Business and Entrepreneurial Lecture Series, sponsored by Clark School Corporate Partner Whiting-Turner Contracting Company. In the fall of 2006 Evan Jones, then chairman and chief executive officer of Digene Corporation, shared his company's rise to national leadership in molecular diagnostics, and Kathy Hill, senior vice president and general manager of the Ethernet & Wireless Technology Group for Cisco Systems, Inc., described how Cisco became the industry leader in Ethernet switching through startup acquisitions, internal development and business strategy. (To view lectures, visit www.eng.umd.edu/whitingturner.)

PHOTO BY AL SANTOS

From left, Dean Nariman Farvardin joins 2006 White Symposium panelists Barry West, Andrew Viterbi and Rajiv Laroia.

White Symposium: Emphasis on Innovation

The Charles and Helen White Symposium explores the relationship between engineering innovation and modern society. The symposium, linked with the Clark School's Innovation Hall of Fame induction ceremony, honors the tradition of technology visionary and steel manufacturing innovator Charles M. White, B.S. '13, mechanical engineering. This year's topic, "Innovation: Fueling a Communications Revolution," drew Barry West, chief technology officer and president of 4G mobile broadband for Sprint Nextel; Andrew Viterbi, co-founder and retired chairman and chief technical officer of QUALCOMM; and Innovation Hall of Fame inductee Rajiv Laroia, M.S. '89 and Ph.D. '92, electrical engineering, founder and CTO of Flarion Technologies, recently acquired by QUALCOMM. (See related story, p. 7; to view the White Symposium, see www.eng.umd.edu/news/news_story.php?id=965).

PHOTOS BY AL SANTOS

Dialogue and Debate

The Whiting-Turner Business and Entrepreneurial Lecture Series continues to bring industry leaders to campus. Left, Robert M. Metcalfe, high-tech venture capitalist at Polaris Venture Partners. Below, Irwin Jacobs, co-founder and chairman of the board of QUALCOMM. Above right, Kathy Hill, senior vice president, Cisco Systems.

PHOTO BY AL SANTOS

A Wealth of Departmental Lectures

Clark School institutes, departments and centers create targeted opportunities for technical leaders to interact with Clark School faculty and students about research and applications, from the Leaders in Mechanical Engineering Lecture Series to the Department of Chemical and Biomolecular Engineering Lecture Series, to the HyNet Colloquium sponsored by the Maryland Hybrid Networks Center, a NASA commercial space center. Even local chapters of national organizations, like the Institute of Electrical and Electronic Engineers, hold regular meetings at the Clark School.

Jefferson Tester

Give and Take

Greg Jackson, associate professor of mechanical engineering and member of the steering committee of the new University of Maryland Energy Research Center, coordinates the Clark School's new "Transforming Energy" series. These lectures examine the challenges of developing breakthrough energy technology for a sustainable future. Speakers have included Jefferson Tester, Massachusetts Institute of Technology; John Turner, National Renewable Energy Labs; and Patricia Dehmer, U.S. Department of Energy Office of Basic Energy Sources.

"Energy-related research is a priority for the university and the Clark School," says Jackson. "This lecture series shows faculty and students what is happening in the field, fosters discussion and galvanizes the direction we want to take with our own initiatives and research."

Experts outside the school often make compelling and convincing arguments about the significance of faculty research, which can bolster faculty confidence in the validity of their work, Jackson adds. In some cases, faculty members find natural collaborators for current and future projects. At the same time, lecturers carry what they learn here to other venues. "These lectures let speakers see what the Clark School is contributing to the field," says Jackson. "They acquaint the world with the Clark School's work."

***To learn more about schoolwide and departmental lecture series, visit the events section of the Clark School website at* www.eng.umd.edu/events.**

Making the Leap

Hillman Program Builds Entrepreneurs, Communities

Michael Sesay grew up in Sierra Leone, where he was surrounded by an entrepreneurial culture and a strong sense of community. "People grew their own food and sold it at the markets. Many worked in their own businesses," Sesay recalls.

When he came to the United States as a teenager, Sesay (photo below) brought that entrepreneurial spirit and sense of community with him to Prince George's County, Md., home to the Prince George's Community College (PGCC) and the University of Maryland. In high school he tutored other students, was a computer coordinator for an afterschool program, and on weekends cleaned and rebuilt homes for low-income families in economically challenged areas.

He enrolled in college. Although dwindling finances forced him to drop out in 1998, the resilient young man found full-time work as a computer resource technician in Washington, D.C. Thanks to his employer's flexible scheduling, he is now back in school at PGCC, completing an associate's degree in computer information systems.

At PGCC he was selected for an exciting new program, administered jointly by PGCC and the Clark School's Maryland Technology Enterprise Institute (MTECH). It will help him make the leap from community college to the University of Maryland and, in the process, cultivate his entrepreneurial skills and perhaps one day build a business that will give new economic vitality to his community.

A New University-Community College Partnership

The Hillman Entrepreneurs Program, launched last fall through a $1.7 million gift from the David H. and Suzanne D. Hillman Family Foundation, seeks to transform entrepreneurial PGCC students like Michael Sesay into new business and civic leaders for Prince George's County. With financial support and intensive mentoring from successful entrepreneurs, including David Hillman, the program enables students to continue their education at the university, where they obtain classroom and experiential training in entrepreneurship, build bonds that will evolve into lifetime friendships and business networks, and earn bachelor's degrees. (Note that the Hillman program is separate and distinct from the Hinman Campus Entrepreneurship Opportunities program, also administered by MTECH.)

Nineteen students comprise the initial cohort. They have already traveled to the university to tackle challenges and build leadership skills through a university-led Leadership Ropes Course. They are taking advantage of Clark School resources that include MTECH's Technology Start-up Boot Camp and $50K Business Plan Competition.

By breaking the boundaries that traditionally separate community colleges from universities, the Hillman program offers a new academic partnership model in which students begin at PGCC in the four-year scholarship program and seamlessly transfer to Maryland after earning associate's degrees.

"We want to support people who can change our world, who have roots in this area and who, after getting this great education, will go back to Prince George's County and shake things up," says David Hillman, chief executive officer of Southern Management Corporation and of the Hillman Family Foundation. He is committed to supporting Hillman students throughout their undergraduate

Michael Sesay is part of the inaugural class of the Hillman Entrepreneurs Program.

The initial class of students in the Hillman Entrepreneurs Program and David Hillman (front row, center)

educations so long as they maintain their academic eligibility and adhere to program values. He is also interested in measurable results. "An assessment tool is already in development by graduate students in the School of Public Policy," says Karen Thornton, the Hillman program director at the university. "Mr. Hillman will assess our progress. If the model works well, he has spoken of expanding the program to local two-year schools in other communities in which his company has a presence."

Individualized Attention

"The Hillman Entrepreneurs Program has huge potential to change lives and to change communities," notes Thornton. "To realize that potential, we must recognize that each student has individual needs and his or her success and the success of the program depend on our meeting those needs." Thornton's job begins in earnest this fall when the first full cohort arrives at the university, but she is already helping Hillman students plan their transfers and is working with the PGCC program director, Lisa Rawlings, to recruit future classes.

"Anyone who has doubts about the future of our country," says Rawlings, "should speak to these students. It astounds me what they have done with their lives and what they have the potential to do."

To date, Hillman students have come from a variety of majors: engineering/computer technology, business, general studies, economics and elementary education. Many already have experience with their own businesses, including residential property investing, video recording and production, tutorial services, lawn care services, and marketing and event promotion.

"Whether they start their own or become part of established ventures, the resources and expertise they can access through the Hillman program will change their lives," explains Rawlings. "Our students have lots on their plates. Their goal is to finish school but they often need a great deal of flexibility, especially for those who do not have a safety net of family support. This program provides that support."

Michael Sesay looks forward to continuing his studies at the University of Maryland. "I have done network development and problem solving for small businesses, and I would like to build that into a consulting firm," says Sesay, who "wants to find a way to help others in what I know best."

What is the Hillman program's most important aspect? According to Sesay, it is students learning from students. "It is important to know that you are not alone out there. It is great for us to share ideas that we can all improve upon. I know I have the technical skills to succeed, and through the Hillman program I now have the resources."

Hillman Program Directors Karen Thornton (right), University of Maryland, and Lisa Rawlings (left), Prince George's Community College.

Guiding the Entrepreneurial Spirit

Dedicated educators like Karen Thornton, supported by dedicated donors like David Hillman, in an environment that fosters innovation—these are the keys to the Clark School's national leadership in entrepreneurship education and support programs.

"Combine the Clark School's spirit of innovation with the vision and funding of a David Hillman and you have the perfect means to inspire the next generation of entrepreneurs," says Thornton. "The Hillman program encourages students to work in a community of entrepreneurial thinkers, and bring that sense of community home to where they live. We just guide it along."

Thornton is highly skillful in guiding student entrepreneurs. For six years, she served as program director for Hinman Campus Entrepreneurship Opportunities (CEOs), the nation's first living-learning entrepreneurship program. The Hinman CEOs Program places entrepreneurially-minded students from all academic disciplines in a unique living community where they learn to be successful entrepreneurs and build new ventures. The program was created with a $2.5 million gift from Brian Hinman, B.S. '82, electrical engineering, to foster an entrepreneurial spirit on campus.

All in the Family

Gil Graff, B.S. '72, aerospace engineering, has spent the better part of his career in research and technological development in the Office of Naval Research, where his work has focused on the application of high-speed aerospace technologies to naval weapons.

"I am directly involved in providing advanced military capability for the next generation of weapons for the U.S. Navy," explains Graff, a program manager working on the development of hypersonic weapons as part of a national initiative in hypersonic technologies. His work is a direct outgrowth of the pioneering research of Clark School Innovation Hall of Fame member Frederick S. Billig. "Hypersonics is the science and technologies that enable flight at five times the speed of sound and greater. These technologies, which include aerodynamics, scramjet engines, aerothermal modeling and simulation, high-temperature capable materials, advanced cooling systems and lightweight structures, will enable affordable access to space and high-speed cruise weapons and aircraft."

Now Graff is watching another career unfold as his son Steven embarks on his own engineering quest as a freshman at the Clark School. "We share an interest in engineering," says Graff. But make no mistake, "Steven is not following in my footsteps. This interest is all coming from Steven; he has always been a self-motivated child."

Steven was admitted to several Ivy League schools, but chose the Clark School bioengineering program for its "newness," including the energetic faculty of the Fischell Department of Bioengineering. "They are ready to work with you, ready to teach," relates Steven. "The faculty are open to new ideas from students and they know how to interact with us."

PHOTO BY MIKE MORGAN

Gil Graff is enjoying his return to the Clark School, where son Steven achieved a 4.0 grade point average in his first semester.

A Future Agenda

That interaction is especially important to Steven, who comes to the Clark School with an agenda. Afflicted with muscular dystrophy since birth and acutely aware of the limitations of the nation's health insurance system, "I dream about telling insurance companies that they had better give me health insurance coverage because I discovered the cause of muscular dystrophy," says Steven, who maneuvers around campus in his electric wheelchair. In years to come, he would like to attend medical school and conduct neurological or genetic research to "engineer" a cure and broaden health care coverage for individuals diagnosed with the disease.

His inspiration came in high school, when he worked as a member of his school's first robotics team in a project sponsored by technology pioneer and Segway founder Dean Kamen. "He is one of the biggest names in the field of prosthetics," says Steven. "We had to design and build a robot in six weeks with a goal to improve biomedics or prosthetic limbs."

Now, he participates in the university's Gemstone program, which provides intensive research experiences for selected undergraduate honors students with interests in science and technology. "We are learning the steps to follow in conducting research," says Steven, who has also joined the Biological Resources Engineering Society. "We are just getting our feet wet, then we will form our research teams and pick a topic."

Advances in Teaching

Gil envies how engineering is taught today. "The advances in learning have been eye-opening," he says. "Faculty members are motivated and the environment is extremely stimulating."

He recalls one of his early engineering courses in airplane design. "Thirty years ago, the aerospace department had four or five scientific calculators, and you had to sign up to use them." Today, his son and other students are already working on industry-standard software. That level of sophistication impresses Gil and contributes to the excitement shared by father and son. "It is always exciting to be on the ground floor of a program," admits Gil. "Given Steven's personal interests in the area of disabilities, there is so much opportunity in the field of bioengineering."

Gil also appreciates the opportunity for self-sufficiency that his son finds at College Park, thanks to so many physical improvements on campus. "With all of the ramps and wheelchair-accessible buildings and walkways, Steven can get around campus fairly well. That would not have been possible years ago," says Gil.

Havener Room Reflects Engineering School History

While the Kim Engineering Building is less than two years old, its Christopher A. Havener '80 Deans Conference Room holds an important record of Clark School history.

In addition to its expansive conference table, comfortable seating for 30, and the latest computer projection system, the Havener room is home to a historic portrait gallery. Along its walls, 10 framed photos of former engineering school deans and acting deans define the school's enduring legacy of progress during the last 113 years, from Thomas Taliaferro to Herbert Rabin.

The room is named for Christopher A. Havener, B.S. '80, law enforcement, a senior vice president in Merrill Lynch's private banking and investment practice and donor to the school.

PHOTO BY BILL GEIGER

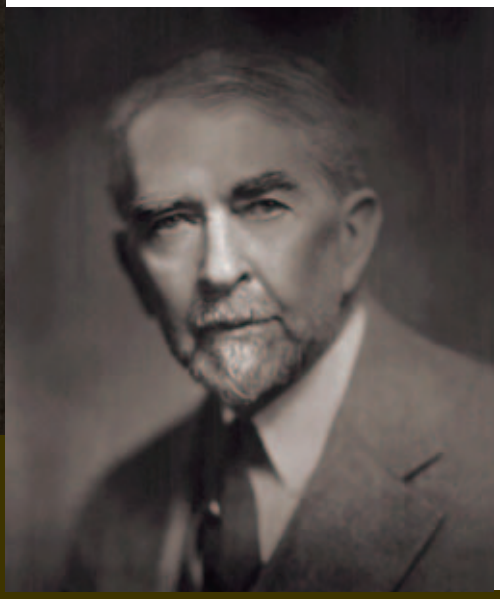
Left to right: Former dean and current university provost William Destler, current dean and professor Nariman Farvardin and former acting dean and current MTECH director and associate dean Herbert Rabin admire the portraits in the Havener Deans Conference Room.

A Celebration of Leadership

Beginning with this issue, *E@M* will highlight the exceptional leaders represented in the Havener portrait gallery. This continuing series opens with a celebration of two early deans who laid the foundation for the school's achievements.

Thomas H. Taliaferro, the first dean of the College of Engineering from 1916 to 1921, was a nationally renowned educator. In 1927, he became dean of the College of Arts and Science at Maryland, a post he held until 1937 when he was appointed dean of the faculty, a newly created position. One of the most prominent Episcopal laymen in Washington, he previously served as the first president of the University of Florida.

Taliaferro received his bachelor's degree in civil engineering from Virginia Military Institute and his Ph.D. from Johns Hopkins in 1896. At the time of his death in 1941 University President H. C. Byrd said, "No man has contributed more to the university's general welfare nor to the raising and maintenance of its educational standards" than Taliaferro. The original mechanical engineering building in the university's mall area still bears his name.



Above: Thomas H. Taliaferro.
Right: Arthur N. Johnson.

Arthur N. Johnson, a graduate of Harvard University in civil engineering in 1894, became the college's second dean. In a nation that was becoming obsessed with the automobile, Johnson was an expert on the surfaces that would make driving possible. Known as the "father" of the state's first hard-surface road system, he served as president of the American Society of Civil Engineers and was internationally recognized for his pioneering efforts in hard-road construction.

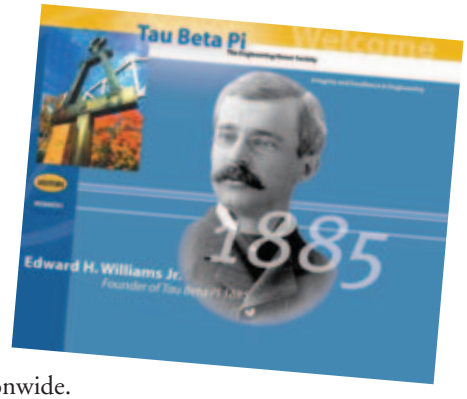
Johnson published a number of articles dealing with a wide array of highway engineering problems, including highway reports for Maryland and Illinois and a digest of highway laws of the United States. Prior to joining the university, he was a state roads engineer, laid the first hard test-road in Maryland and was responsible for mapping out a system of hard-road construction for the entire state, which was authorized by a $5 million bond issue in 1908.

Kim Kafe Debuts

Whether they are cramming for exams or working on group projects, Clark School students can now easily refuel without ever leaving the Jeong H. Kim Engineering Building. Located on the first floor of the Kim Building, the Kim Kafe opened to rave reviews this fall. Breakfast pastries, salads, snacks, coffee and expresso are available throughout the day along with prepared gourmet sandwiches. Stop by during your next visit to the Clark School.

PHOTO BY AL SANTOS

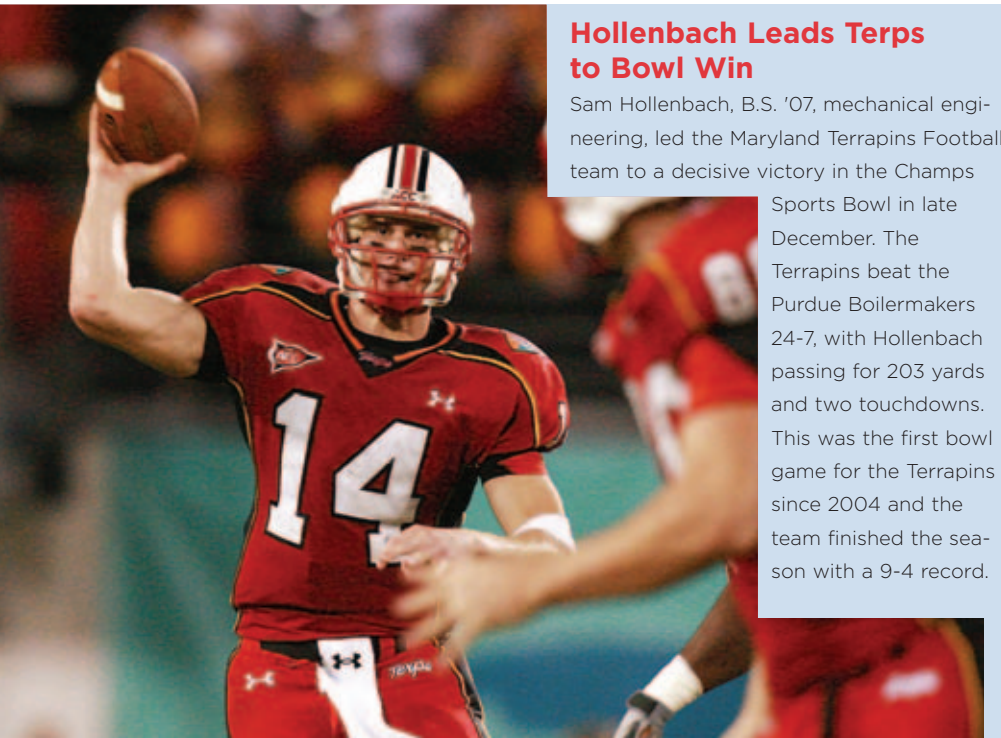
Clark School Honor Society Leads the Nation



The Clark School chapter of Tau Beta Pi, the nation's engineering student honor society, received the R.C. Matthews Award for Most Outstanding Chapter for 2005-2006, topping more than 300 chapters nationwide.

The Clark School chapter has won the award 11 times, most recently in 2001. Last year the Clark School chapter sent students to the Gulf states during winter and spring breaks to help residents affected by Hurricane Katrina.

For more information on the chapter's activities, visit www.eng.umd.edu/TBP/index.php.



Hollenbach Leads Terps to Bowl Win

Sam Hollenbach, B.S. '07, mechanical engineering, led the Maryland Terrapins Football team to a decisive victory in the Champs Sports Bowl in late December. The Terrapins beat the Purdue Boilermakers 24-7, with Hollenbach passing for 203 yards and two touchdowns. This was the first bowl game for the Terrapins since 2004 and the team finished the season with a 9-4 record.

Alumni News

PROTAGORAS "TAG" CUTCHIS, B.S. '79, electrical engineering (EE) and physics, and M.S. '90, EE, was selected by *Scientific American* magazine as a research leader in the 2006 "Scientific American 50" list. A senior engineer at the Johns Hopkins Applied Physics Laboratory, he was cited for developing a device that could enable amputees to communicate desired movements simply by thinking about them.

ANUBHAV DATTA, M.S. '01 and Ph.D. '04, aerospace engineering, and assistant research scientist and lecturer in the Clark School's aerospace engineering department, received the Francois-Xavier Bagnoud Award from the American Helicopter Society (AHS) International. The award recognizes outstanding contributions to vertical flight technology by an AHS member under the age of thirty.

ELIAS SHAMS, B.S. '90, EE, is the new CEO of Searchles, an intelligent social search platform that integrates popular Internet tools like bookmarking, tagging and content-sharing with in-depth search features.

DAVID TAHMASSEBI, B.S. '86, EE, is the new president and CEO of Led Engin, a company that produces ultra high-power light-emitting diodes.

Lower Your Estate Tax and Support the Clark School

Charitable Remainder Trusts Offer Significant Tax Benefits

This is one of a series of articles that will provide information on specific giving methods during the Great Expectations *campaign.*

GREAT EXPECTATIONS
THE CAMPAIGN *for* MARYLAND

Alumni and friends of the Clark School offer a variety of reasons for maintaining or renewing their ties to the school. An alumnus might want to recognize the school's role in preparing him to launch his professional career, or feel indebted for financial support that enabled him to complete his studies, or want to express gratitude for the dedication of a revered professor. A corporate partner might value the steady stream of well-trained engineers produced by the school to satisfy her company's employment needs.

To strengthen these bonds—and to improve their tax situations—many alumni and friends decide to make financial gifts to the school. *Great Expectations: The Campaign for Maryland* offers a perfect opportunity to begin the gift planning process.

Choosing the Best Option for You

For many, a bequest is the simplest way to make a gift to the Clark School. Bequests can be made through gifts of cash or personal property. In a cash bequest, the university receives a specific amount of money, while in a property bequest, the university receives all or a percentage of selected assets such as securities, real estate or tangible personal goods such as art or antiques.

Increasingly, donors seek ways to give during their lifetimes. A charitable remainder trust (CRT) offers the perfect vehicle for lowering estate taxes and supporting the Clark School. To create a CRT, donors irrevocably transfer money, securities or other assets such as real estate to a trust that pays them an income for life or for a period of years. When structured properly, the CRT provides a lifetime income stream for donors and their spouses, reduces income taxes and potentially eliminates estate taxes on appreciated assets. Depending on individual goals and needs, CRTs can be structured to pay either set annuities or variable amounts.

One of the most effective ways to fund a gift is through highly appreciated assets that are currently generating low income; these assets can be contributed and used to create a CRT with the university with no tax consequences. At the death of the last beneficiary, the Clark School receives the remaining principal in the trust.

Advantages of a Charitable Remainder Trust

Assumptions

Beneficiary Age(s)	64 and 60
Principal Donated	$1,000,000
Gift Date	Dec. 31, 2006
Payout Rate	6.00%
Payout Schedule	Quarterly

Benefits

Charitable Deduction	$251,050
First Year's Income (future income will vary with trust value)	$60,000

Note: Contributions of property with short-term gain or other ordinary income may reduce your deduction. These calculations are estimates of gift benefits; actual benefits may vary.

Viable, Tax-Saving Gifts

"Integrating tax and investment planning is critical to helping clients reach present and lifetime financial goals," says Ron Lara, B.S. '68, civil engineering, a financial planner for 29 years. "If you own a C corporation business, are interested in selling rental property that has appreciated dramatically or are interested in selling greatly appreciated stock, a charitable remainder trust may be a viable tax-saving option that provides a considerable tax deduction, avoids the capital gains tax on the sale of these assets and supports the Clark School at the same time," he notes.

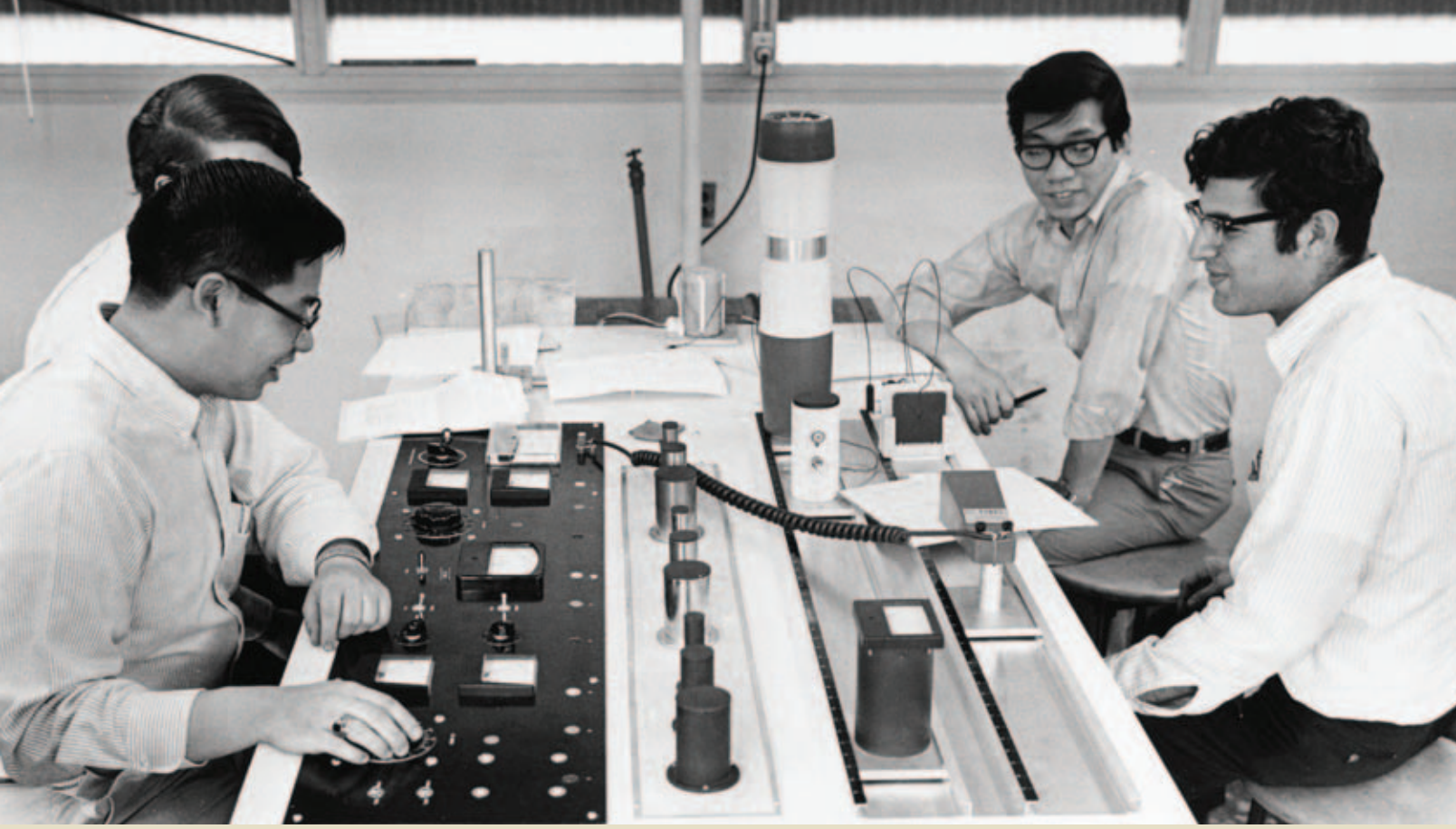
Variations on the CRT offer further options. A charitable remainder unitrust (CRUT) provides an annual percentage payout that is based on the annual fair market value of the assets. The payout increases or decreases based on the appreciation or depreciation of the market value. A CRUT can accept additions to the trust at any time.

The charitable remainder annuity trust (CRAT) provides an annual payout based on the market value of the assets as of the date the trust is established. A CRAT can be funded only at the time of acquisition and cannot accept additions to the trust after the initial contribution.

Lara advises, "Look at how the CRT can help you achieve tax savings during the remainder of your lifetime. By avoiding capital gains and creating a tax-deductible charitable donation, you can realize a 15 to 50 percent increase in income from assets, depending on your age. For many people, that increase can mean a more comfortable retirement."

THE CLARK SCHOOL DEVELOPMENT STAFF CAN HELP YOU WITH YOUR PLANNED GIVING QUESTIONS. FOR MORE INFORMATION, PLEASE CALL OR WRITE:

Steve Beeland, assistant dean for external affairs, Clark School of Engineering, University of Maryland, College Park, Maryland 20742-2831 ■ 301.405.0317 ■ sbeeland@umd.edu



Do You Remember?

Do you know what is going on in the photo above? When it was taken? The names of the people shown? Send your answer to mcorley@umd.edu and you may be eligible for a prize!

Winner of Last Issue's Contest

Congratulations to Andrew Valente, B.S. '90, fire protection engineering, who correctly identified Prof. John Bryan instructing fire protection engineering students about sprinklers in the 1960s. He won a copy of the video "Keeping The Promise: The Rise of The University of Maryland." His name was drawn at random from those who submitted correct answers. Congratulations to all who guessed right!

GREAT EXPECTATIONS
THE CAMPAIGN *for* MARYLAND

Remember This

You can help to protect the Clark School's history and create an even brighter future by participating in *Great Expectations: The Campaign for Maryland*. Thank you for your support.

A. JAMES CLARK
SCHOOL OF ENGINEERING

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