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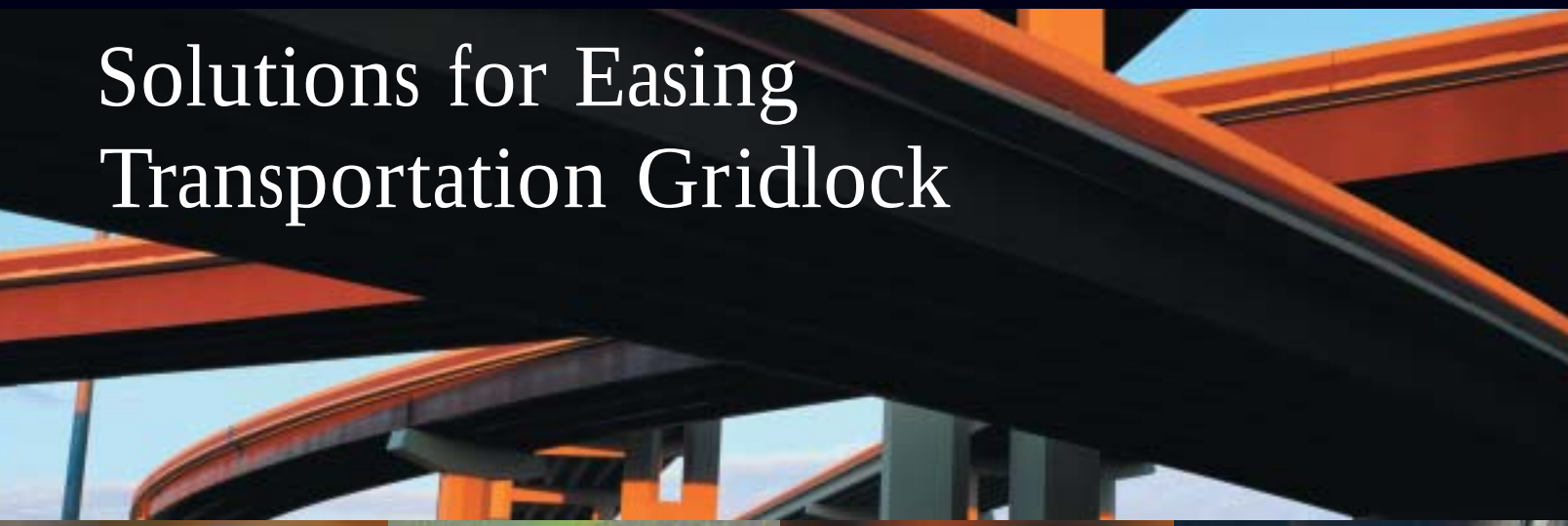
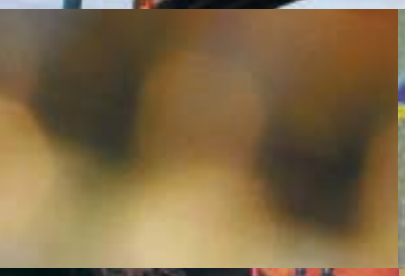
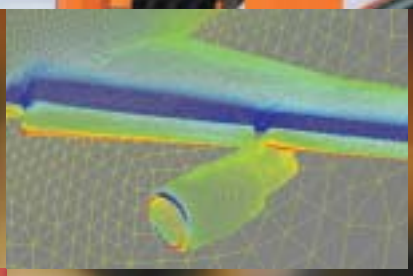
ENGINEERING @ MARYLAND

Solutions for Easing Transportation Gridlock







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Engineering @ Maryland is published twice a year for alumni and friends of the A. James Clark School of Engineering and the Glenn L. Martin Institute of Technology at the University of Maryland.

Letters to the editor and alumni notes are welcome. Please send them to *Engineering @ Maryland* Editor, 1137 Glenn L. Martin Hall, University of Maryland, College Park, MD 20742. Information can be sent by fax to 301.314.9867 or by e-mail to ckaufman@eng.umd.edu

Dear Alumni and Friends:

THIS YEAR MARKS THE centennial of flight. Imagine the thrill the Wright Brothers must have felt that day in December of 1903, when after years of trial and error, they successfully tested their heavier than air machine in a controlled flight lasting just twelve seconds. Years later, they would set an endurance record of over thirty minutes. While many thought these brothers a bit odd, by 1909 their newly found airplane company would "get off the ground" and their conquest of flight changed the world.

The Wright Brothers had a vision, driven by the question, "what if?" Their story captures the fundamental nature of scientists and engineers, and conveys a guiding principle of the Clark School—the support of inquiry, investigation, and the discovery of "what if?"

Throughout this issue of *Engineering @ Maryland*, you'll read about the many ways the Clark School is providing opportunities for research that are leading to discoveries and meaningful applications. Our feature story on transportation, for example, demonstrates our leadership in research and education programs in transportation systems. Study in this important field will lead to improvements not only for the daily commuter, but also for safety preparedness, and for our economy.

You also will read about our endeavors to provide a full spectrum of undergraduate research opportunities that draw students directly into the discovery process as an integral part of their engineering education.

Other stories in this issue show the Clark School's commitment to provide the resources necessary to support technology development and advancements that boost economic development, and assist with the growth of small technology companies. The Glenn L. Martin Wind Tunnel and the Maryland Technology Enterprise Institute (formerly the Engineering Research Center) are two such resources. And the construction of the new Jeong H. Kim Engineering and Applied Sciences Building promises a state-of-the-art infrastructure devoted to stimulating the discovery process.

The "virtual" groundbreaking ceremony for the Kim Engineering Building scheduled for February 17, 2003, was postponed due to a severe snowstorm. I am pleased to announce that we will celebrate this event on Wednesday, May 14. We will communicate the details of this event to all our Clark School friends very soon.

We are very excited about the construction of this new facility. Every aspect of the building will be used to educate tomorrow's engineers, and it will house some of the most sophisticated engineering research and educational laboratories in the nation. This facility will feature almost 10,000 square feet of clean room space and will support cutting edge research in nanotechnology and smart small systems, transportation systems, biotechnology, wireless and multimedia technologies, and optical communication systems, to name but a few. Our faculty and students will be able to expand the limits of their own disciplines through collaborations with other engineering units. Through these alliances, new models, new paradigms and new knowledge will transpire.

To accomplish our goals and maintain the quality of our engineering program, we need your help. As Maryland legislators tackle difficult budget decisions, your support for the university and for the engineering program are crucial to our future success.

Giving to education is one of the most rewarding gifts you can make. Your support of higher education fuels lifelong dreams and opportunities for dedicated young men and women. I invite you to visit our new giving web site: **www.eng.umd.edu/giving**. As you navigate through the site, you will access important information on the types of gifts you can make to support the Clark School—scholarships, annual fund, professorships, naming opportunities in the new Kim Building or endowed funds that will support our ongoing operational needs. Your support demonstrates your leadership and commitment to ensuring that Maryland continues as one of the top engineering programs in the nation.

I encourage you to support the university and the Clark School of Engineering by staying involved with us.

Nariman Farvardin, *Professor and Dean*

F-16XL Scamp Flow Visualization Test at NASA's Langley Research Center

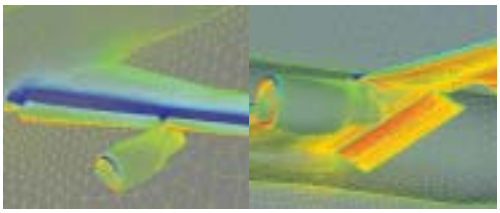
NASA Taps Maryland for National Institute of Aerospace

The University of Maryland, along with six other highly regarded institutions, will form the nation's first National Institute of Aerospace (NIA).

The institute was created through an innovative partnership between NASA and the National Institute of Aerospace Associates (NIAA), a non-profit corporation formed by Maryland and other higher education institutions and the American Institute of Aeronautics and Astronautics Foundation. According to NASA, the new NIA will conduct cutting-edge aerospace and atmospheric research, develop new technologies for the nation, and help to educate and inspire future generations of engineers and scientists.

Masters' and doctoral degrees in science and engineering will be offered through the institute using local and affiliate campuses, as well as the latest innovations in distance learning. Some students will have the opportunity to divide time between their home campus and the NIA central campus, which will be located in Hampton, Virginia, adjacent to and associated with NASA's Langley Research Center.

"The National Institute of Aerospace is a bold new partnership between NASA's first research lab and top universities in the nation," says Charles E. Harris, director of the NIA Management Office. "The Clark School of Engineering brings more than 50 years of aerospace expertise to this consortium."



At Langley, advanced computers are used to simulate the air flow over a complex aircraft wing.

While students will receive degrees from their home campus, all students enrolled in the NIA program will benefit from the expertise of each of the participating institutions. For example, students at any of the NIA institutions will have access to the Clark School's renowned expertise in launch and re-entry vehicle technology; aerodynamics, aero-thermodynamics and acoustics; structures and materials; and atmospheric science. They also can take advantage of the courses or expertise available from the other participating institutions: University of Virginia, Virginia Polytechnic Institute and State University, North Carolina State University, North Carolina Agricultural and Technical State University, and Georgia Institute of Technology.

"NIA is a major new research and educational asset for the nation," says William Destler, university senior vice president for academic affairs and provost. "Our participation is yet another example of the Clark School's ability to compete against the best engineering programs in the country for vital new research initiatives and centers."

This innovative partnership between NASA and NIAA is comprised of a cost reimbursable, indefinite delivery/quantity contract and a cooperative agreement. The maximum value of the contract for a five-year base period is $49 million. The value of the basic five-year cooperative agreement is $69 million. If the three, five-year options are exercised under the cooperative agreement, the combined potential total value would be $379 million. ■

Whiting-Turner Contracting Company Boosts Support

The Whiting-Turner Contracting Company generously committed a gift of $500,000 for the Jeong H. Kim Engineering and Applied Sciences Building, in honor of the company's executive vice president and University of Maryland alumnus Charles A. Irish, Sr.

"Once again, we are the grateful recipients of the loyal support for engineering education at Maryland by Whiting-Turner and Chuck Irish," states Nariman Farvardin, dean of the school of engineering.

This gift will be used for construction and equipment costs, in addition to supporting an endowment for the building's future maintenance. A computing laboratory will be named for Irish, as requested by the company, in recognition of their contribution.

"The support of companies such as the Whiting-Turner Contracting Company and dedicated people such as Chuck Irish is crucial to ensuring the success of a strong educational program and developing a skilled workforce that is needed today," explains Willard Hackerman, president of the company. ■

Five Illustrious Leaders Join Board of Visitors


Gessow


Gooden


Hamilton


Lacey


Linsert, Jr.

Five new members add their leadership to the Engineering Board of Visitors. The board provides counsel to the dean regarding the mission, goals and strategic plans of the school.

The Clark School is honored to welcome these new members:

JODY GESSOW, who resides in California, is a real estate developer and investor in distressed real estate and private equities, and president of Argosy Development Corporation. He also acquires, owns and manages commercial office buildings in Tokyo. Gessow served as an adjunct professor of management for several years at Emory University, where he received a B.B.A. in finance. He received his M.B.A. from Harvard University.

LINDA GOODEN is the president of Lockheed Martin Information Technology and an officer of Lockheed Martin Corporation. Her fast-growing 7,000-member organization is responsible for information technology contracts that supply business systems, managed services and infrastructure solutions for customers of U.S. defense and civil departments, states and commercial companies. She serves on a number of government and nonprofit boards, and has received numerous awards for her contributions to the information technology field. Gooden received her bachelor's degree in computer technology from Youngstown State University and completed post-baccalaureate studies at San Diego State University.

BRUCE HAMILTON is the president of the technologies sector of BAE SYSTEMS. He leads a group of systems and software engineering companies that provide electronic systems and technical services to the U.S. defense industry, NASA, FAA and foreign governments. He received a B.S. in engineering physics from University of Oklahoma and earned his M.S. in engineering mechanics from the University of Texas.

MARY LACEY is the technical director of the Naval Surface Warfare Center (NSWC), and the most senior civilian in NSWC, which employs 17,000 people and has a $2.9 billion business base. She leads a network of technical installations, including six divisions. In Lacey's 28-year career with the Department of the Navy, she has distinguished herself as a leader dedicated to science and technology in support of the nation's defense. She received a B.S. in mechanical engineering from the University of Maryland, where she also completed graduate work in control systems and explosives. Her numerous awards include the 1999 Distinguished Engineering Alumna Award.

HENRY (PETE) LINSERT, JR. is the chairman and chief executive officer of Martek Biosciences Corporation in Columbia, Md. A success story out of Maryland's Technology Advancement Program, Martek develops and sells products derived from microalgae. Before joining Martek, Linsert served in leadership positions for a number of venture capital companies. He received a B.A. from Duke University and his M.A. in economics from George Washington University. ■

Inventor, Entrepreneur Robert E. Fischell Joins Faculty

Robert E. Fischell has joined the Clark School of Engineering as Professor of the Practice in the mechanical engineering department. In this position, he will engage in teaching, research, mentoring students, and participating in the Clark School's numerous efforts that promote technology entrepreneurship.

His brilliant career includes experience as an engineer and scientist in the private and government sectors, first at the Johns Hopkins University Applied Physics Laboratory in space technology. Later, his career interests gradually shifted from space technology to an emphasis on how space technology can be applied to enhance the quality of life through the development of novel medical devices. Today, he is the chairman of Fischell Biomedical, LLC and Angel Medical Systems, Inc.

Fischell has a profound understanding of the practical application of engineering principles, coupled with a strong ability to comprehend medical concepts. "Robert Fischell is tireless in his efforts in seeking innovative solutions for unmet medical needs," says Robert Croce, company group chairman, Johnson & Johnson. His work has resulted in a large variety of medical device improvements and technologies including the first implantable insulin pump, the rechargeable pacemaker and highly flexible stents for placement in coronary arteries.

"With his vast experience and contributions in the field of biomedical devices, Robert Fischell will serve as an inspiration and role model for our students studying bioengineering and biomedical systems development, and play a vital role in our various programs related to technology entrepreneurship," states Dean Nariman Farvardin.

Fischell received his B.S. in mechanical engineering from Duke University in 1951, and an M.S. in physics from the University of Maryland in 1953. He was awarded an honorary doctoral degree from the University of Maryland in 1996. He 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. Fischell serves on the Clark School Board of Visitors, as well as on the University of Maryland, College Park Foundation Board of Trustees. Last year, Fischell was inducted into the Clark School Innovation Hall of Fame and received Maryland's 2001 Major F. Riddick, Jr. Entrepreneurship Award. ■

$1.5 Million NSF Grant Funds Performance Research

The design, planning, control and management of high-performance communication networks require a highly integrated approach, where each layer of the network is designed and optimized simultaneously. With a three-year, $1.5 million National Science Foundation Information Technology Research (ITR) grant, Clark School researchers are looking at the various layers of ad-hoc wireless networks to improve access, speed and reliability.

Anthony Ephremides, professor of electrical and computer engineering; John Baras, the Lockheed Martin Chair in Systems Engineering; and Professors Richard La and Sennur Ulukus of electrical and computer engineering, received the ITR grant to develop "Vertical Protocol Integration in Ad-hoc Wireless Networks." Ephremides is the principal investigator for the project.

Ad-hoc networks, which forego existing communication systems such as base stations, satellite networks or the Internet, place users in direct communication and have a wide range of applications, most immediately as sensor networks for the military, explains Ephremides. This study breaks new ground in networking research, exploring beyond the established paradigm of cellular networks and wireless local area networks, he adds.

The main focus of the research is on the interaction between the physical layer, the media access control (MAC) layer, and the routing/transport layers of the network. Because ad-hoc wireless networks are subject to more pronounced interdependencies among the various layers, the networks could benefit significantly from cross-layer designs.

The Clark School team will take into account the nature of the wireless medium by detailed modeling of the transmission parameters and by considering multiple means of network access, including transmission at different times, in different frequencies and using different codes.

Energy consumption and signal compression also will be investigated. "Ad hoc networks rely on batteries and have a finite amount of energy," says Ephremides. The researchers will look at how to provide the highest value or quality of transmission at the lowest possible energy rate. ■

Professional Recognition and Honors

Abed Named ISR Director

Eyad Abed, professor of electrical and computer engineering, has been named director of the Institute for Systems Research (ISR). In his new position, Abed will lead the institute's efforts to launch new and exciting research and educational programs and to strengthen its external partnerships.

Recognized for his work in the area of control systems, Abed's research includes contributions to the control of nonlinear systems exhibiting bifurcation and chaos; singular perturbation analysis and reduced-order modeling; nonlinear stability and stabilization; linear robust stability; gas turbine jet engine dynamics and control; aircraft control; and radar system dynamics.

Abed is a fellow of the Institute of Electrical and Electronics Engineers and a recipient of the Presidential Young Investigator Award from the National Science Foundation, the O. Hugo Schuck Best Paper Award from the American Automatic Control Council, the Outstanding Systems Engineering Faculty Award of the ISR, the Alan Berman Research Publication Award from the Naval Research Laboratory, and two university teaching awards.

He serves on the editorial advisory board of *Nonlinear Dynamics*. Abed received his bachelor's degree from the Massachusetts Institute of Technology in 1979 and his master's and doctoral degrees from the University of California, Berkeley in 1981 and 1982, respectively. He joined the University of Maryland in 1983.

Mikhail A. Anisimov, professor in chemical engineering, was selected as a fellow by the American Association for the Advancement of Science. The prestigious honor is awarded for efforts toward advancing science or fostering applications that are scientifically or socially distinguished. Anisimov was selected for distinguished contributions to chemical thermodynamics.

Christopher Davis, professor of electrical and computer engineering and in the Institute for Systems Research; Stuart Milner, senior research scientist, Institute for Systems Research; and Uzi Vishkin, professor of electrical and computer engineering and Maryland Optics Group, have received a nine-month, $300,000 Defense Advanced Research Projects Agency (DARPA) grant under its TeraHertz Operational Reachback (THOR) program. The THOR program is developing optical wireless links that will form an "Internet in the Sky" and allow very high data rate transfer to anywhere in the world in a secure way, without the need for installed fiber optic infrastructure.

Reza Ghodssi, assistant professor of electrical and computer engineering, is the principal investigator for a new three-year, $270,000 National Science Foundation grant, "Micro-Ball Bearing Technology for Micro-Electro-Mechanical Systems (MEMS)." His research program investigates the use of micro-ball bearing technology for MEMS and micro-machinery applications.

Arthur Johnson, professor of biological resources engineering, was elected a fellow in the American Society of Agricultural Engineers, the society for engineering in agricultural, food and biological systems.

K. J. Ray Liu, professor of electrical and computer engineering, has been named a fellow of the Institute of Electronic and Electrical Engineering. He has also been named editor-in-chief of *IEEE Signal Processing Magazine*, the most widely read journal in the signal processing community. He also currently serves as editor-in-chief of *EURASIP Journal on Applied Signal Processing*.

Hani S. Mahmassani, the Charles Irish Chair in Civil and Environmental Engineering and director of the Maryland Transportation Initiative, has been named editor-in-chief of *Transportation Science*, a journal of the Institute for Operations Research and the Management Sciences (INFORMS), recognized as the leading scholarly journal in the transportation area. ■

The Ethics of Engineering

Explosive technological changes in the field of engineering pose challenging ethical questions for both the seasoned and novice engineer. The month of February marks the celebration of National Engineers Week and one of the Clark School's annual events is the Order of Engineers.

Engineering students who are graduating in May as well as alumni are invited to be inducted into the order and accept the Obligation of the Engineer, which advocates maintaining high standards and exhibiting exemplary character. Lockheed Martin has sponsored this event for the last few years through financial support and by providing the keynote speakers.

Nancy McCready Higgins has served as a past keynote speaker and demonstrates the commitment of the company to ethical business practices. Higgins joined Lockheed Martin in 2000 as vice president, ethics and business conduct, and has a direct report to Chief Executive Officer Vince Coffman and Chief Operating Officer Robert Stevens. She is immediate past chair of the Working Group of the Defense Industry Initiative on Business Ethics and Conduct, a consortium of defense contractors that subscribes to and promotes high standards of ethical business.

Higgins shares her thoughts on the growing complexity of the engineering profession and the resulting ethical issues.

Q What advice do you have for members of the engineering profession?

A "Realize at the onset of your careers that you are a part of something larger than yourself. Look at your own ethics and professionalism as part of your daily work process. Know your actions will always have consequences beyond what you may be aware of and always consider how your decisions on the job will affect others."

Q How is the world changing for engineers in the workforce today?

A "Today's young engineers face a very different world than a generation ago. Engineers must use their special expertise to be voices in the discussion about setting the right course for the future.

The issues involved with projects are becoming more complex, and today's engineer needs to be willing to recognize he/she does not have all of the answers. You must explore outside of your respective disciplines and be willing to consider the thoughts and ideas of lay people who may represent a different perspective. In a technical sense, engineers have a responsibility to stay current and keep up their level of expertise through continuing education so ultimately they have as much information and are as informed as possible in making major decisions."

Q How do you see ethics integrated into an engineering education?

A "Engineering students need to understand how often in their daily work they will be faced with ethical decisions. In the workplace, you won't always have a great deal of time to consider an issue. In so many cases, if you are not prepared in advance, if you don't have your ethical principles firmly in place, you may not make the right decision. And you may have to live with the consequences of the wrong decision for the rest of your life.

I would like to see ethics embedded in all engineering training. In every course, especially the applied courses, there are many opportunities to discuss how ethical decisions are made. Ethics should not necessarily be a separate course in a student's education."

Q What is the approach to ethics and business conduct at Lockheed Martin?

A "Lockheed Martin has offered a formal ethics and business conduct program since the company was formed in 1995. We promote six basic ethics in the workplace: respect, trust, responsibility, citizenship, integrity and honesty. Our ongoing ethics awareness training helps employees to resolve ethical issues they encounter on the job by applying these principles in the appropriate fashion. We also have an Ethics Helpline, ethics officers throughout the company and a comprehensive compliance training plan in place to provide employees with an awareness of the company policies, laws and regulations that apply to their jobs. You want to be sure that your employees have all of the information they need to make good ethical decisions."

UNDERGRADUATES EXPERIENCE

The Thrill of Discovery

MOST ENGINEERING SCHOOLS TODAY STILL VALUE THE IMPORTANCE OF TRADITIONAL, LABORATORY-RELATED COURSEWORK THAT PROVIDES STUDENTS WITH THE FUNDAMENTALS OF RESEARCH. THE CLARK SCHOOL OF ENGINEERING IS TAKING AN ADDITIONAL APPROACH—ONE THAT EXPANDS THE RESEARCH EXPERIENCES AND DRAWS STUDENTS DIRECTLY INTO THE DISCOVERY PROCESS.

While undergraduate research has long been a priority of the Clark School, these days, there is a broad-based effort to systematically and formally establish funded research opportunities as key components to the undergraduate experience. "We think it is important to seek and obtain funding with one objective in mind—dedicated undergraduate research opportunities—where students, not faculty or graduate students, may initiate research," says Engineering School Dean Nariman Farvardin, who notes that the Clark School's approach is resulting in a growing number of programs with resources earmarked specifically for this purpose.

"Discovery is about exploring new territories, it is about finding something that was previously unknown," Farvardin explains. "Research brings out all of a student's potential and offers a significant dimension to their undergraduate experience."

Farvardin is optimistic that early involvement in research will excite students and encourage them to continue their work through graduate school and, ultimately, throughout their careers. "One of the pressing issues that our nation struggles with is to encourage more American students to pursue careers in research," says Farvardin. "We want to do our part to fuel the research engine of the nation."

The Clark School attracts students of the highest caliber, particularly as they recognize that a well-rounded engineering education can include exciting, cutting-edge programs. "We are attracting tremendously talented students to the Clark School and it is imperative that we give them the kind of work or research experience that will be attractive to employers," affirms Gary Pertmer, associate professor and associate dean of undergraduate students. "Our philosophy is that all undergraduates should have some type of research experience as part of their curriculum and our job is to provide as many opportunities as we can."

The Hinman CEOs and Quest programs, are offered in collaboration with the Smith School of Business to encourage students to develop strong business skills.

Research Opportunities Grow

True to that objective, the Clark School's list of student research opportunities continues to grow. The Hinman Campus Entrepreneurship Opportunities (CEOs) program, one of the most successful programs of its kind in the country, brings together juniors and seniors from several academic disciplines throughout the university (see related story, p. 17). Students live and learn the ropes of entrepreneurship, with a focus on product development research and the creation of business plans that guide their entrepreneurial ventures. Some students have actually launched their own companies through the university's Technology Advancement Program.

Gokul Thirumalai, computer engineering, '04 and a Hinman scholar, spent last spring and summer working for Centeye, a start-up firm in Washington, DC, founded by Geoffrey Barrows, Ph.D. '99 electrical engineering. Funded primarily through the Defense Advanced Research Project Agency (DARPA) of the U. S. Department of Defense, the firm develops visual microsensors for small, unmanned space vehicles.

"The sensors help the vehicles to detect obstacles in their way and to process changes in altitude," says Thirumalai, whose diverse assignments for Centeye included writing the programming for the sensors. "The founder of Centeye took time to educate me not only about this project, but about the technological and business aspects of running a company," offers Thirumalai, who is now looking to take Centeye's product, available only through DARPA, to the commercial sector through the Hinman program.

Gemstone, an invitation-only program for top-performing students, is another innovative program that was created in response to employer feedback that engineering graduates entering the work force could benefit from greater experience

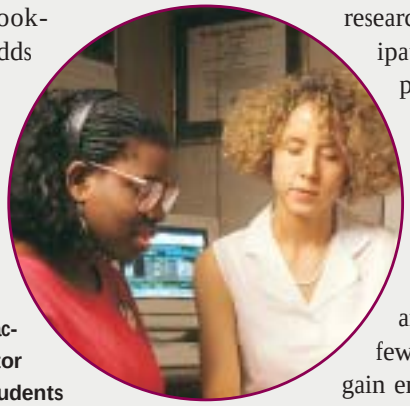
Product development is a major component of many of the Clark School's undergraduate research programs.

working in teams and in a multidisciplinary environment. The program, now in its seventh-year admits some 180 students each fall. Working in teams over a three-year period beginning as sophomores, these students tackle complex research problems with societal, technical or scientific aspects. Like the Hinman program, Gemstone attracts students from a wide variety of disciplines throughout the university including business and the social sciences, although most participants are engineering or science majors.

"This is a very different and special opportunity for talented undergraduates. They can participate in a long-term research experience, as well as benefit from working with a mentor who is committed to the student team for the entire project duration," says Jim Wallace, Gemstone director and professor of mechanical engineering.

"The leadership at the Clark School understands that engineering is more than looking narrowly at technical problems," adds Wallace. "Engineers must look at all dimensions, including the societal impact and commercial implications of new technologies."

The innovative QUEST (Quality Enhancement Systems and Teams) program also offers a collaborative experience. In this instance, it is in collaboration with the Robert H. Smith School of Business. High-achieving business and engineering majors participate in team-based courses where they gain skills in project management, product design and customer management. Additionally, undergraduates can partner with faculty and staff on projects with direct industry relevance and real-world engineering projects through another Clark School scholars program called ASPIRE.



Female faculty mentor female students through the summer Research Internships in Science and Engineering program.

Summer Initiatives Attract Students

Through the generous support of the National Science Foundation (NSF), the Clark School has broadened its research offerings to students in many key areas. As a recipient of a number of NSF-funded Research Experiences for Undergraduates (REUs) sites, the Clark School is able to strengthen its latest technological initiatives with new awards. REU sites have allowed visiting students and University of Maryland students to work during the summer together with internationally recognized faculty in their respective fields and participate in team-based, cross-disciplinary research.

Another NSF-funded program, an intensive, eight-week summer Research Internships in Science and Engineering (RISE), matches female faculty mentors from the Clark School and the College of Computer, Mathematical and Physical Sciences (CMPS) with female students. "The research component is particularly significant because we are providing students with opportunities to work on research as a member of a team and meet role models at all levels." notes Linda Schmidt, an associate professor of mechanical engineering and one of the principal investigators for the RISE grant.

MERIT (Maryland Engineering Research Internship Teams) presents yet another opportunity for undergraduates to spend their summer pursuing research in one of three concentrations—telecommunications, power and energy electronics or computer engineering. The program, also open to students from across the country, combines lab work with weekly technical seminars, presentations, guest speakers and field site visits.

Internships and Co-op Placements

Students may also follow more traditional routes to meaningful research experiences. Some 1,000 students each year participate in paid internships and cooperative education placements with Fortune 500 corporations, private companies and government laboratories and entities.

The list of participating companies is impressive and includes Black & Decker, Exxon Mobil, General Electric, Honeywell, Lockheed Martin, Northrop Grumman, United Technologies and government agencies such as the National Security Agency, NASA and the Naval Surface Warfare Center, to name but a few. Students in science, technology and engineering also gain employment at a wide variety of industrial companies each summer through the Maryland Technology Enterprise Institute (see related story, p. 16).

Stephen Kerber, fire protection engineering '03, worked for nearly a year for the National Institute of Standards and Technology in the Firefighter Technology Group of the Building Fire and Research Laboratory. Kerber, the son, grandson and nephew of firefighters, and a volunteer firefighter himself with the College Park Volunteer Fire Department, assisted the group in its research on fire protection clothing and thermal imaging cameras. Working with a simulator, he also studied how fires begin and spread.

"I actually did a lot of full-scale testing," says Kerber, who furnished a room, took specifications on all the items in the room and, with investigators and cameras watching, set the room on fire. "We were able to determine the circumstances—temperature and the ventilation point—at which the fire reached its highest intensity," he explains.

"We are really trying to instill in our undergraduates the desire to solve problems, to look at things from different perspectives, to apply analytical tools and to trust and apply their intuition through research," adds Pertmer.

Bioengineering Graduate Program Launched

THE CLARK SCHOOL OF ENGINEERING has launched a graduate program in bioengineering that combines research and education opportunities and leads to a master's or doctoral degree.

The program provides a basic understanding of bioengineering at the molecular and cellular level, focusing on biomolecular and cellular rate processes; cellular and tissue biomechanics; electrophysiology of the cell; and cellular and physiological transport phenomena.

The highly cross-disciplinary program draws on the resources of many of the Clark School's departments, in addition to the departments of biology, cell biology and molecular genetics, chemistry and biochemistry, computer science and mathematics.

"We want to marry the principles and applications embedded within engineering with the sciences of biology, medicine and health," says William Bentley, the first Herbert Rabin Professor of Engineering and director of the bioengineering program. "We believe that developments at the interface of biology and engineering will advance the efficacy of health care by creating new paradigms for the diagnosis of disease and the delivery of new therapeutics."

Faculty members in the Clark School are currently engaged in bioengineering research in such areas as medical diagnostics; signal processing and imaging; cellular and metabolic engineering; vaccine development; biomedical devices; instrumentation; and work in collaboration with nearby health care facilities, medical schools and biomedical research centers.

Bentley Named to Rabin Professorship

WILLLIAM E. BENTLEY has been named the first Herbert Rabin Distinguished Professor in Engineering. Internationally recognized for his work, he brings extensive experience in the area of bioengineering to his new position.

His outstanding record of technical contributions to the field includes work in metabolic engineering, modeling of genetic circuits, cellular stress responses and E. coli protein expression, bioreactor design and optimization, and insect cell and larvae/baculovirus expression systems. His current research integrates mathematical modeling and molecular biology to improve production processes of human pharmaceuticals, enabling drugs to be produced more efficiently and cost effectively.

Bentley joined the university in 1989, with a joint appointment between the Department of Chemical Engineering and the Center for Agricultural Biotechnology. He has served as the director of the Bioprocess Scale-up Facility of the Maryland Technology Enterprise Institute since 1994 (see related story, p.16).

The author of 92 publications, Bentley serves on the editorial board of *Biotechnology Letters*, Kluwer Academic Publishers. He is a fellow of the American Association for the Advancement of Science and the American Institute for Medical and Biological Engineering. He currently serves as chair of the Biochemical Technology Division of the American Chemical Society. He has received numerous honors, including the Society of Industrial Microbiology's Schering-Plough Young Investigator Award; the Dow Outstanding Faculty Award; the Washington Academy of Sciences Outstanding Achievement in Engineering Sciences Award; and the Allan C. Davis Medal as the Outstanding Young Engineer in the state of Maryland.

He received his B. S. and M. S. from Cornell University and his Ph.D. from the University of Colorado, Boulder, all in chemical engineering.

The Rabin Professorship, established by an anonymous donor, supports new and emerging fields in engineering and honors Professor Herbert Rabin's dedicated service to the engineering profession and industry. Rabin, is the associate dean for research and director of the Maryland Technology Enterprise Institute.

Fischell Fellow Designs New Diagnostic Technologies

ONE NEED ONLY TO READ current headlines, says Angela Hodge Miller, to understand the challenges that face today's biomedical engineering industry. "Americans and other members of the global community are greatly concerned about the need for early detection of toxins—in individuals, in the air, on land and in the water," she adds.

More specifically, Hodge Miller refers to the anthrax spores sent through tainted letters to select members of Congress. "At least one building in the District of Columbia continues to be a threat to anyone who enters," she asserts.

Hodge Miller hopes to accelerate the toxin detection process through her design of a multi-sensor, self-testing fluid analyzer that will enable a diagnosis to be made more quickly and more efficiently. The device utilizes the very latest methodology, Systems-on-a-Chip, that incorporates multiple technologies on a single microchip. In Hodge Miller's case, testing procedures are created on the same chip with biosensors, a strategy that could eliminate errors associated with standard chip testing mechanisms and at the same time simplify the self-diagnostic process.

Her research and her ability to "think outside the box," have earned Hodge Miller the honor of being named the first recipient of the Fischell Fellowship in Biomedical Engineering.

The fellowship, designed to go beyond scholarly achievement to produce new medical systems and devices to treat disease, was established through a $1.25 million gift from inventor, engineer and physicist Robert E. Fischell.

In recent years, explains Hodge Miller, who is pursuing her Ph.D. in electrical engineering, there has been a strong effort by researchers to use engineering principals to solve problems related to the determination of impurities in biological fluids. However, many chemical sensors can not be applied to a broad spectrum of fluids.

Hodge Miller is focusing most of her research on developing chemical sensors capable of performing selective determination of compounds in a variety of fluids, such as blood, urine and saliva. "In addition to being useful in the clinical analysis process, the array of biosensors I develop will be capable of performing on-chip, real-time, self-diagnostics," she says.

Currently, medical analysis for toxins involves going to a specialist, clinic or hospital, providing a sample and waiting up to two weeks for the results – a time-consuming and often costly process. "This technology will allow individuals and general practitioners to perform analyses in their homes or offices," she says. "The early detection method will aid in preventing the dissemination of false information to the patient and could potentially save lives."

For example, the process can be fine-tuned to detect specific toxins. "The victims of anthrax exposure at the Brentwood postal facility could have known days ahead of time that they had been exposed," she says. "The hospital wouldn't have misdiagnosed them as having the flu."

"By applying specific attachment chemistry to the surface of the sensor, you can isolate and identify a target protein or DNA," offers Hodge Miller. "With the right chemistry, you can detect a specific strain of anthrax or smallpox."

Hodge Miller received her bachelor's degree in electrical engineering from the Clark School in 1996 and her master's degree in electrical engineering from Stanford in 1998. She has interned at various public and government institutions and would someday like to establish her own biomedical engineering consulting firm. "My interest is in working in areas in which I can be creative while meeting the needs of the community at large," she says.

Angela Hodge Miller, the first recipient of the Fischell Fellowship in Biomedical Engineering, is developing chemical sensors that could accelerate the detection of toxins like anthrax.

PHOTO BY LISA HELFERT

New Technologies Hold Promise for *Faster* and *Easier* Transportation Systems

story by Paul Adams

More than a century after the Wright Brothers successfully piloted the first engine-powered airplane, they would barely recognize their own invention. Nor would they fully comprehend how their crude flying machine spawned the creation of a complex, interdependent transportation system that has taken mankind to the far corners of the Earth and to the moon and back.

Researchers at the A. James Clark School of Engineering are moving us into yet another era of transportation — one that relies on massive communications systems and sophisticated software and electronic sensors. Their far-reaching work touches all major modes of transportation and is designed to improve access, enhance safety and increase convenience and speed both in the air and on the ground.

The Friendly Skies

Building on the Wright Brothers' dream of personal air travel, faculty and alumni of the Clark School are working with government and corporate partners to reinvent the way small airplanes are used in today's transportation system, while at the same time easing the headaches of commercial air travel.

Norris J. Krone Jr., B.S. '55, Ph.D. '72, is aiding NASA's efforts to develop a small aircraft transportation system that will make general aviation a viable alternative to transportation on commercial airlines. Krone's work involves developing high-tech, single-pilot aircraft capable of operating in all kinds of weather without the assistance of airport radar and control towers, which are often absent at small community airports.

"The idea is to make general aviation more efficient as part of a larger transportation system, which means using smaller airports and avoiding the big, congested hubs," says Krone, whose doctoral thesis provided the technical foundation for the development of the U.S. Department of Defense x-29 experimental aircraft.

Krone, who heads the University Research Foundation and its subsidiary, the Maryland Advanced Development Laboratory, has equipped a twin-engine Cessna 402 with the same sophisticated avionics and communications equipment that jetliners and military fighter planes use to navigate under difficult conditions. He believes much of this high-priced technology will become more affordable in the decade ahead, making it possible for general aviation pilots to fly safely in difficult weather without using airport landing aids.

Aviation experts suggest another way to reduce congestion on major airport runways is to use more small planes that can take off and land on shorter, underutilized runways. Doing so would change air traffic patterns and noise levels over many residential communities, but Ella Atkins, assistant professor of aerospace engineering, is working on software to mitigate that problem.

"We are looking at noise models for various types of rotorcraft and small aircraft so that the noise generated on the ground is minimized," offers Atkins. "Years from now, our work could open air space previously not used by commercial aircraft and increase passenger throughput to major metropolitan airports."

Amr M. Baz, professor of mechanical engineering, is also exploring new methods of noise reduction. Baz uses sensitive electronic sensors to measure noise-causing vibrations in everything from aircraft to power tools. "We measure the vibration and acoustics and then provide control actions to reduce noise," Baz explains, noting that his technique is patented and has been employed to reduce cabin noise in small planes and helicopters.

Baz's work complements research conducted at the Clark School's internationally recognized Alfred Gessow Rotorcraft Center, honored with last year's Grover E. Bell Award from the American Helicopter Society for its pioneering contributions in smart structure technologies that successfully transition into full-scale helicopter systems. The center is at the forefront of research on rotorcraft aerodynamics, composite structures, flight mechanics, acoustics and other aspects of rotorcraft engineering.

Darryll Pines, associate professor of aerospace engineering, uses the resources of the Rotorcraft Center to advance his research, particularly with large unmanned aircraft and micro unmanned air vehicles (UAVs), which fit in the palm of the hand. "The physics of flight at the micro scale has not been studied significantly," says Pines. "The propulsion and power, structure and material, and aerodynamic needs and the whole spectrum of design and configuration for these vehicles is open to research."

Technology aside, one of the biggest challenges is how to integrate large and even the smallest unmanned aircraft into the traditional Federal Aviation Administration-regulated infrastructure. "Right now, the technology of unmanned air vehicles is used primarily by the military to observe ground operations," adds Pines. "But, there are hundreds of civilian applications, including the capability for these vehicles to act as their own wireless cellular networks, but the FAA must first wrestle with all of the policy issues, such as air space, landing and take-off restrictions."

Pines, along with colleagues Norman Wereley and Inderjit Chopra, are also looking to implement "morphing wings" as a characteristic of the new unmanned aircraft. He predicts that morphing aircraft structures will become part of a formalized flight test program in the next five years. "We are looking at using advanced materials to change the shape of the vehicle and its





ability to carry weight," asserts Pines, who explains that morphing structure technology could address future military mission needs, potentially enabling an actual vehicle to morph into a weapon.

While research on aviation alternatives of the future is charting the course for commercial and unmanned air travel, many new technologies are currently being applied to make daily travel on the ground easier and more convenient.

On the Road Again

The Clark School is gaining momentum in developing intelligent transport systems, which provide traffic managers, emergency responders and motorists with everyday traffic information that could eliminate much of the guesswork in the workday commute. Armed with the very latest facts about traffic conditions, motorists can also make better decisions so that, ultimately, congestion will be eased on the most heavily traveled routes.

"The key issue here is real-time information — that is the theme that runs through much of our work," says Hani Mahmassani, the Charles A. Irish, Sr., Chair in Civil and Environmental Engineering; and head of the Maryland Transportation Initiative, the umbrella organization for the university's various transportation research centers.

In his own work, Mahmassani is developing computer programs to predict how motorists will respond when presented with real-time information about traffic conditions, such as accidents. State and federal traffic managers may be able to influence driver behavior and keep traffic running more smoothly using his modeling software.

Another rapidly emerging tool will provide travelers with data using electronic message boards, radio, the Internet, or a cell phone equipped with a global positioning chip. With a cell phone, motorists could dial into the Internet, learn their exact location and download maps, directions, real-time traffic information and travel advice as they are selecting their routes.

"All of these converging technologies are helping to feed the concept of intelligent traffic systems," Mahmassani notes.

In addition to easing commuter congestion, Mahmassani's research has numerous commercial applications. For example, trucking companies or delivery services could use traffic data and complex modeling software to plan their routes or determine pricing strategies.

But first, traffic managers must determine the best way to make the information available to users. To that end, Clark School researchers are working with state transportation officials to outfit Maryland's highways with a network of traffic sensors and video monitors to provide real-time information about accidents and general traffic conditions as part of the Maryland State Highway Administration's Coordinated Highways Action Response Team (CHART) program.

Phil Tarnoff, director of the Clark School's Center for Advanced Transportation, imagines the coming decade when state traffic managers can quickly detect accidents or traffic backups and use road signs or wireless communication to immediately advise travelers to take alternate routes. Today, Tarnoff's group is helping to design the system and develop computer simulations to guide transportation officials on the best method of response to traffic incidents.

The Clark School is also leading an effort to develop a wireless communication system to allow transportation managers, rescue workers and public safety agencies to coordinate their responses to everything from traffic accidents to major disasters. The federally funded Capital Wireless Integrated Network (CapWIN), a partnership between the state of Maryland, Virginia and the District of Columbia, is coordinated through Tarnoff's group at the Clark School.

Using the network, a highway trooper responding to a vehicle accident would activate a specially-equipped laptop in his cruiser, type in the relevant information, exit the car and take control of the scene. The global positioning system-equipped computer would automatically notify authorities of the trooper's location and use wireless communication to begin alerting the appropriate emergency response agencies, saving critical time. The system could even incorporate video, allowing public safety officials to view the incident site.

"We would like to become a national model with the idea that every urban area in the country would have something like this," explains Tarnoff, who says interest in the project has grown since the 2001 terrorist attacks, which exposed the need for better coordination among emergency responders.

Wireless communication also is the foundation for efforts to monitor traffic conditions by pinpointing cell-phone transmissions. David Lovell, assistant professor of transportation engineering, says that by anonymously tracking cell phone transmissions originating from the beltway, researchers can gauge the speed and density of traffic and allow transportation officials to pinpoint trouble spots.

Since motorists are more likely to use a phone to call home or check their voice mail when they are stuck in traffic, such a system would theoretically turn every cell phone user into an unwitting traffic reporter.

"One advantage of a cell phone system is that you are likely to receive data from anyplace where there is a true traffic problem," notes Lovell.

One of the biggest contributors to traffic tie-ups is summer roadwork. Clark School faculty are testing innovations in pavement design that could make roads last longer, resulting in fewer construction delays.

Dimitrios G. Goulias and Charles Schwartz, associate profes-

sors of civil and environmental engineering, are studying high-performance concrete pavements with funding from the Federal Highway Administration and the Maryland State Highway Authority. Their study involves laboratory evaluation of several fiber-reinforced concrete mixtures, which have been used to construct portions of a highly trafficked Maryland bypass to determine the material's performance under real-world conditions. A variety of sensors were built into the concrete test sections to record data on the pavement's durability.

"The results will directly impact the design charts and construction practice of concrete highway pavements in Maryland," contends Goulias.

The two researchers are also studying asphalt pavements as part of two national studies. Through the Superpave project, researchers are investigating new material behavior models for asphalt concrete that capture its complex dependence on temperature, loading rate and stress level. The second study involves developing a new national guide for highway pavement design to replace the current empirical methodology with a more rigorous theoretical approach.

Both of the projects "will allow us to capture the benefits of today's improved paving materials as well as the damage caused by today's higher traffic loads in ways that simply are not possible using existing empirical design procedures," relates Schwartz.

Researchers at the Clark School's Bridge Engineering Software and Technology (BEST) Center are working to improve the safety and efficiency of bridges. Chung Fu, center director, is looking at the use of fiber-reinforced polymer (FRP) composites as an alternative to traditional steel-reinforced concrete on bridge decks. "Composites have an advantage over steel-reinforced concrete in that they take less time to construct and do not corrode when exposed to water and salt," describes Fu, who is currently field testing a newly placed FRP composite bridge deck in Harford County, MD.

FRP road surfaces cost considerably more than but far outlast their conventional counterparts, says Fu. In the long run, by considering the life-cycle cost and increasing the longevity of road surfaces, researchers hope to eventually reduce construction delays and make highways less costly to build, he adds.

Technologies for Trains

For those travelers looking for a more convenient alternative to driving or flying, train travel remains a viable option. A 1994 Clark School Innovation Hall of Fame inductee, Emilio A. Fernandez, '69, is developing electronic braking systems that reduce train stopping distance by 40 percent and cut fuel costs by nearly five percent.

Founded by inventor and industrialist George Westinghouse, Fernandez's company, Pennsylvania-based WABTEC Corporation, pioneered air brake systems that have been the industry standard for generations. More than a century later, the company is marketing the new electronic equipment as an alternative to traditional pneumatic systems that rely on air to deploy brakes on passenger and freight trains.

"With electronic brakes, the signal is sent to all the cars and applied consistently and rapidly, so the whole train comes to a very gradual and very quick stop," explains Fernandez.

The company is also working on positive train control (PTC) systems that allow railroad dispatchers to control train movements by computer. While never a replacement for an engineer, Fernandez believes the system can be used to make train movements more efficient without compromising safety.

"Through PTC, we could reduce the distance between trains in a very safe manner and could move more goods over time," he adds.

Fernandez's work, like that of his Clark School peers, could help to ease bottlenecks on the road and in the air by diverting cargo and passenger traffic to the rails.

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From intelligent transportation systems and the highly accessible technology of cellular phones to the concepts and blueprints for micro-sized unmanned air vehicles, researchers are clearly searching for transportation solutions to meet the challenges posed by today's complex world—a world very much on the move.

Paul Adams is a Maryland-based freelance writer who has written extensively for metropolitan and regional newspapers in Maryland and Minnesota about business and transportation issues.

Transforming Innovations
Into Hard-Driving Results

Since its first experiment in December 1949, the Glenn L. Martin Wind Tunnel (referred to as the Wind Tunnel in this article) has conducted more than 1,800 experiments and projects, which represent more than 65,000 hours of "tunnel time" for a broad range of low speed aerodynamic and hydrodynamic applications.

Performing research and development on virtually every type of transportation vehicle, from jet fighters and transports to Olympic bobsleds, the Wind Tunnel has served as a testing ground for traditional enterprises and entrepreneurs alike.

A high level of flexibility and efficiency along with an extremely qualified workforce contribute to the appeal of the facility to all types of organizations. "There are only a handful of such facilities in the country and we are probably the most active wind tunnel of our kind," says Robert Ranzenbach, a former naval architect and marine engineer, who received his Ph.D. in aerospace engineering from Maryland and joined the Wind Tunnel in 1995. A self-supporting enterprise for more than 50 years, clients appreciate the facility's business approach coupled with the resources of one of the nation's premiere research universities, adds Ranzenbach.

Many entrepreneurs have utilized the Wind Tunnel's capabilities to yield strong results for their respective companies. Constructed as part of a gift to the university from aviator and successful entrepreneur Glenn L. Martin, the facility was used extensively during its early years by Martin's own company, now known as Lockheed Martin, for airplane research and development. In the early 1960s, one of the Wind Tunnel's biggest entrepreneurial successes was in testing the heavy lift capabilities of the double rotor concept for Piaeski Helicopter Company, which pioneered the "Jolly Green Giant" helicopter for the U. S. Army and was ultimately acquired by Boeing Helicopters. Throughout the fuel crisis of the early '70s, testing on tractor trailers led to the development of an integrated roof wedge to install on the top of trucks pulling trailers to reduce drag and fuel usage. "During the 1980s, Ford Motor Company conducted scale model testing of the Ford Taurus, which would become the nation's first mid-size, low-drag vehicle to be fully embraced by the consumer market," explains Ranzenbach. The Wind Tunnel has been the primary provider of model scale aerodynamic research and development to Ford since the 1950s.

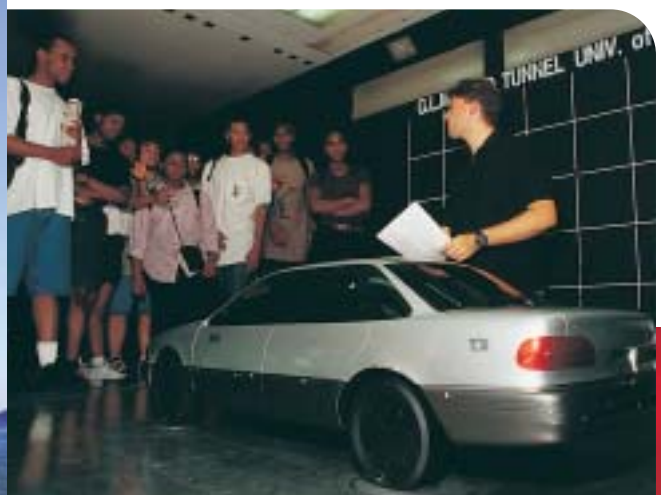
For the last several years, the proximity of the Wind Tunnel to the sailing capital of the world, Annapolis, Md., has led to unique partnerships with leading sail and yacht design firms.

Larry Leonard started a small, family-owned sail loft in Annapolis, in 1976, and became a member of an international company, Sobstad Sailmakers, as a franchise just seven years later. In 1996, Leonard formed his own company, Quantum Sail Design Group, and with the help of a grant obtained from the university's Maryland Industrial Partnerships (MIPS) program he worked with the Wind Tunnel to develop the first U. S.-based testing capabilities for downwind sails.

That research project has fueled much of Quantum's recent achievements, including a complete line of revolutionary asymmetrical spinnakers called the Renegade Series.

"The Wind Tunnel has allowed us to develop asymmetrical spinnakers and prediction capabilities that enable us to compare the performance of sail models prior to the construction of an actual full-size sail," says Leonard.

Starting with a single facility in Annapolis six years ago, Quantum has experienced 15 to 20 percent growth over the



Two internationally recognized, Annapolis-based firms use the Wind Tunnel to test sail and yacht designs (left). Ford Motor Company relied on the facility for scale model testing of the Ford Taurus.

The U. S. Olympic Bobsled Team visited the Wind Tunnel this fall to fine-tune the design of its equipment in preparation for the 2004 Winter Olympics.

last five years and now boasts a network of more than 50 affiliates in 15 countries.

The company, which makes sails for both cruising and racing sailboats, caters to some of the world's most demanding sailors and has provided sails to leading competitors in the world's most prestigious races—including the America's Cup and the Volvo Around the World Race.

As a component of the Maryland Technology Enterprise Institute (MTECH), the Wind Tunnel plays a vital role in attracting new business to the region. In the case of Quantum Sails, Leonard brought potential customers from around the world to the facility to observe product testing. "We basically converted a customer who had been with a much larger competitor for more than 30 years by using the Wind Tunnel as a marketing tool," explains Leonard. "They were impressed by the capabilities here and the information we could gather from our testing."

He notes how his craft has changed and how sailmaking is now a blend of art and science. "We need more science on the front end to continue to be successful," contends Leonard. "In starting this new company, it has been critical that we create strategic alliances with facilities that can provide technology that would otherwise be unaffordable."

Quantum Sails is not the only small local company to benefit from technology support here at Maryland. Since the early '80s, the Wind Tunnel has been the testing site for numerous keel variations for America's Cup and Volvo 60 class yachts through its work with Annapolis-based Farr Yacht Design, one of the top racing-yacht design firms in the world. The Farr-designed Illbruck captured first place in the 2001/2002 Volvo Ocean Race, a trek covering some 32,700 nautical miles.

Farr Yacht Design recently participated in its sixth America's Cup campaign, as part of the design team for the U. S. based Oracle Racing Team, assembled by the chairman and chief executive officer of the Oracle Corporation.

"As everything about sailing becomes more competitive, you have to look harder to find performance gains that will increase your probability of winning a race," says Stephen Morris, Farr vice president and former senior designer. "The harder you look, the more sophisticated the tools you must use."

"The quality of data acquisition and the special equipment in the Wind Tunnel give us an advantage in making fine variations in model geometry and measuring more precisely the air pattern or the flow field around the models," he adds.

Just as the staff closely followed the progress of the America's Cup contenders, they will be carefully watching the 2004 Winter Olympics for the U. S. bobsled team, whose members traveled to the Clark School last fall to test the latest bobsled designs.

The Wind Tunnel's expertise and reputation in aerodynamic testing led the bobsled team to the College Park campus. "In testing innovations over time, it is so important that baseline data is reliable and that all data is consistent from day-to-day and year-to-year," says Bob Cuneo, owner of Chassis Dynamics, a leading national race car design firm, who was enlisted to lead Olympic bobsled development efforts by NASCAR driver Jeff Bodine, a decade-long supporter of the initiative. "The Wind Tunnel has proven to be a superb resource for us for that reason."

Cuneo employs a constant wind speed and direction while testing sled shape changes and crew position changes on actual size bobsleds. He describes how his project embodies entrepreneurship and small business innovation—vital components in the success formula for both entrepreneurs and the Wind Tunnel team.

"A testament not only to engineering and manufacturing, the bobsled project also demonstrates what small industries can accomplish working together," explains Cuneo, who notes that he relies primarily on small independent businesses rather than large corporate sponsorships to advance the bobsled project. "American ingenuity and the manufacturing ethic is alive and well and we are able to compete with countries spending millions of dollars on this same effort," he adds.

There is no doubt that with resources such as the Glenn L. Martin Wind Tunnel at their service, entrepreneurs can beat the learning curve and use the latest research data for considerable market advantages and gains.

MTECH: New Name Marks Growing Role of Engineering Research Center

For almost 20 years, the Clark School's Engineering Research Center (ERC) has promoted partnerships with local industry to support collaborative research that leads to the development of advanced technologies, new companies and growing employment opportunities. Changing the center's name to Maryland Technology Enterprise Institute (MTECH) is an acknowledgement of the leadership this institute continues to offer in terms of technology transfer and economic development throughout the region.

"We're excited about the evolution of the ERC," shares Herbert Rabin, director of MTECH. "Our new name broadly encompasses our current successful programs, as well as several new initiatives."

"At MTECH, we remain firmly committed to advancing technology in Maryland—through collaborative research opportunities, company incubation and expert solutions for regional companies—but we are also implementing several new important initiatives to promote and support, entrepreneurship and growth in the biotech sector of the Maryland economy," Rabin adds.

"The institute and its programs also create a dynamic, technological and entrepreneurial environment for undergraduates, graduates and faculty members," confirms David Barbe, professor of electrical and computer engineering and MTECH executive director.

The ERC began as an initiative to promote greater coordination and collaboration between the engineering school, the university and industry. One of the ERC's most successful programs, the Technology Advancement Program (TAP), continues to provide incubator facilities, business and technical support to technology-based early stage companies.

Since its inception in 1984, TAP has generated $373 million in investment funding. Among their most impressive graduates are two of the state's powerhouse public biotechnology companies, Martek Biosciences Corporation and Digene Corporation. Digene developed the only Federal Drug Administration-approved test for the human papillomavirus (HPV), the cause of most cervical cancers, and Martek's infant formula product is licensed to more than 60 percent of infant formula manufacturers worldwide.

Much of the institute's success lies in its ability to provide a channel for discovery by matching university resources to industrial challenges and involving faculty and students in the process. Created in 1974, the Maryland Industrial Partnerships Program (MIPS) promotes technology transfer from the university to industry.

"Faculty from all University of Maryland campuses participate in the MIPS program and we consistently have greater demand than we are able to support," says Barbe.

Industry partnerships through MIPS have spawned the recent development of the only Internet satellite consumer product available in the country, a commercially successful drug to prevent respiratory disease in infants, and PDAs that are translating languages for soldiers in the fields in Afghanistan.

The Hinman Campus Entrepreneurship Opportunities (CEOs) program (see related sidebar) adds a significant component to MTECH capabilities, affording students the advantage of participating directly in entrepreneurial ventures. Some 20 new companies are forming this year as part of the program.

Through the Institute's Maryland Technology Extension Service (MTES), faculty share their knowledge base by providing on-site technical solutions for improving manufacturing processes. For

Maryland faculty assisted in developing the only Internet satellite consumer product available in the country through MIPS.

MTECH, a major contributor to the region's future biotechnology ventures.

example, last year, Maryland manufacturers reported that MTES consultative services made a $30 million impact by helping firms reduce actual costs, increase competitiveness and retain sales.

The Institute's services have also contributed to the growth of biotechnology in Maryland, which is currently ranked third in the nation for the number of biotech companies. "From a global point of view, biotechnology holds huge promise for the future," notes Rabin. From medical to agricultural to animal-related applications, Rabin sees endless possibilities for new therapies, products and analysis techniques in bioengineering.

Investment funding through TAP assisted a local biotechnology company in developing its infant formula product.

In its ever-expanding role, MTECH is poised to provide even greater contributions to bioengineering ventures. The Institute's Bioprocess Scale-up Facility (BSF), a state-of-the-art laboratory for developing and scaling up biotechnology products and processes including a new, 250-liter computer-controlled fermentor, has benefited such clients as Becton Dickinson Microbiology Systems, Human Genome Sciences and the Naval Research Laboratory. Its new Productivity Enhancement Program is applying lean manufacturing principles to biotechnology and the innovative Technology Enterprise Accelerator Program is forming business ventures based on intellectual property created by university faculty, students and staff by providing venture-consulting services to early-stage tech ventures and inventors. Outside the classroom, graduate students from all disciplines are exploring venture formation and technology commercialization through the newly created Technology Club.

Rabin notes how the institute's broad range of services complements the Clark School's academic offerings. "If you look at most engineering colleges, you will almost certainly find the traditional disciplines represented, such as mechanical, civil and electrical engineering," he says. "However, it is relatively unique to have an institute such as MTECH reach across all departments to foster industrial partnerships."

Hinman Program Recognized as National Leader

The Hinman CEOs program was recognized as a national leader in entrepreneurship education this fall when the program received the Price Institute Innovative Entrepreneurship Educators Award during the prestigious Roundtable on Entrepreneurship Education for Engineers (REEE) held at Stanford University. REEE gathers top business, science and engineering faculty from leading universities in the United States to accelerate entrepreneurship education for scientists and engineers.

The award, in its first year, recognizes the nation's most innovative college entrepreneurship program for scientists and engineers. The Hinman program was selected from an impressive group of competitors that included Harvard, Georgia Tech, University of Southern California and Case Western Reserve.

"The University of Maryland program stood out from the others because it provides a total immersion in entrepreneurship," says Tina Seelig, executive director of the Stanford Technology Ventures Program, which sponsors the roundtable. "The engineering and business students live and work together as they engage in entrepreneurial pursuits. Many programs encourage cross-campus collaboration, but few provide such rich opportunity for the cross-pollination of ideas."

Now in its third year, the Hinman CEOs program, is a joint initiative of the Clark School and Smith School of Business that brings undergraduate students together in a dynamic, living-learning experience that spurs the formation of new ideas and substantial creative ventures. The program features a high-technology, office-like environment that gives students the tools they need to run their own companies, complemented by a weekly seminar series and an annual Business Plan Competition, which offers funding for the most promising new ventures.

The program was funded by a $2.5 Million gift from Brian Hinman '82. ■

First-Ever Solar Decathlon Team

The University of Maryland's Solar Decathlon Team placed fourth in a national collegiate competition sponsored by the U. S. Department of Energy this past fall to build a solar-powered house. The Maryland team was one of 14 finalists selected to display its houses in a week-long event on the National Mall in Washington, DC.

The 30-member, cross-divisional team of undergraduate students designed and built an 800-square foot, solar-powered house and succeeded in winning first place for heating and energy balance. They also received high marks for assessment of the home's heating and cooling systems.

The team paid particular attention to designing a home that would fit into an average neighborhood. Team members handled all assignments from designing and building the house to raising funds for the project to transporting the house to the National Mall.

Several thousands of visitors went through the house and 200 alumni attended a special tour and presentation made by Nariman Farvardin, dean of the Clark School of Engineering. ■

The Maryland team placed first in the design of the heating and energy balance system for its solar-powered house.

Tau Beta Pi Receives Twelfth Outstanding Chapter Award

The Clark School's chapter of the Tau Beta Pi Engineering Honor Society received the R. C. Matthews Most Outstanding Chapter Award for an unprecedented 12th year. The award was presented this fall at the honor society's national convention in Detroit.

The University of Maryland chapter is the most decorated of more than 200 chapters in the nation. It also received the Chapter Projects Award, Secretary's Commendation and Chapter Projects Grant for 2001-2002. The chapter was recognized for its numerous community service projects and extensive community outreach as well as the high level of performance of its members.

"Our students have always taken great pride in belonging to Tau Beta Pi and they understand that with their membership comes a commitment of service to the school," says Gary Pertmer, associate professor and associate dean of undergraduate students and one of four faculty advisers for the chapter. "The continuing recognition of the University of Maryland chapter shows that our students excel both within and outside the academic setting." ■

Materials Engineering Society Recognized

The Clark School's Materials Engineering Society (ASM/TMS Joint Student Chapter) won a Chapter of Excellence Award for its promotion of the field this fall. The award, presented by the two major professional societies in the materials science and engineering fields, is one of only five offered internationally. The Clark School chapter was recognized for events and activities planned and offered last spring, including monthly meetings with guest speakers and alumni. Previously, the chapter was recognized for its membership development and chapter management activities. ■

Gessow Center Earns Top Honors for Fifth Consecutive Year

406 UMTerpRanger

For the fifth year in a row, a team of graduate students from the Alfred Gessow Rotorcraft Center won first place in the annual AHS/INDUSTRY/NASA Student Design Competition. "Our continued success in this competition is testimony to the innovative spirit of our students, faculty and researchers in the Alfred Gessow Rotorcraft Center," says Dean Nariman Farvardin.

Students were charged with taking existing aging light helicopters and upgrading them to increased performance, safety and reliability standards at a fraction of the cost of a newly manufactured helicopter. The winning Clark School team proposed an upgrade program for the Bell Model 206 JetRanger, the 406 UMTerpRanger.

The design competition is sponsored by American Helicopter Society International-The Vertical Flight Society, a professional, technical society founded in 1943 and representing the interests of the worldwide vertical flight industry. NASA is also a major underwriter of the program. ■

Notable Alumni

Clark School Alumni Receive Highest Honor from ASCE

This fall, two graduates of the Clark School were inducted as honorary members to the American Society of Civil Engineers (ASCE), the highest honor bestowed by the society.

A. James Clark

A. JAMES (JIM) CLARK '50 was recognized by the ASCE for his outstanding leadership and accomplishments spanning over 50 years in the construction industry and his support of engineering education, research and community development.

Clark is the chairman of Clark Construction Group Inc., one of the nation's largest general building contractors. His Bethesda, Maryland-based holding company, Clark Enterprises Inc., includes real estate, communications and commercial and residential construction enterprises.

In the fall, Clark was inducted into the Washington Business Hall of Fame. Founded by the Washington Board of Trade and *Washingtonian Magazine*, the Hall of Fame celebrates the most illustrious business people of the greater Washington community. Clark was one of five 2002 laureates honored at the Hall of Fame's 15th anniversary dinner, one of the most prestigious events of the year in the Washington region.

Clark received his bachelor's degree in civil engineering. ■

Raymond Krizek

RAYMOND KRIZEK '61, was recognized by ASCE for his extensive contributions to the knowledge base of geotechnical engineering through his research, teaching, consultation, publications, professional activities and overarching leadership.

Krizek, a member of the National Academy of Engineering, is currently the Stanley F. Pepper Chair in Civil Engineering and director of the master's in project management professional degree program at Northwestern University in Evanston, Illinois.

He received his M.S. in civil engineering from the University of Maryland and his doctorate from Northwestern University. In addition to teaching, Krizek has published more than 300 technical papers and reports and has testified before Congress in matters related to civil engineering. ■

Alumni Volunteer to Support the Clark School

Twelve engineering alumni recently volunteered to form an Annual Giving Leadership Task Force. The task force will evaluate current outreach efforts and marketing strategies to determine the best approach to increase awareness of alumni activities, and to boost volunteer and financial support.

Co-chairing the task force are alumni and engineering Board of Visitors members Ron Lowman '67 and Greg Moores '80. "The Clark School is one of the country's leading engineering schools. We want to ensure that our strong record of achievement progresses, and that engineering alumni have an active role in that progress." says Lowman. "Working as a team, we can reach a number of our fellow classmates and graduates. We want to enlist their help in supporting the research and education programs of their alma mater," adds Moores.

Volunteer committee members include Ali Hirsa '93, '98; Mike Herson '72; Mary Lacey '78; Brian LeGette '89; Jennifer Nelson '82; John Tighe '82; Richard Vogel '72, '80; Pedro Wasmer '62; Dierdre Willard '87; and Phil Wiser '90. The task force will play an important role in attracting annual support for the Clark School.

If you would like information on how to join the annual giving leadership task force or want information on other Clark School funding initiatives, please contact Nelson G. Marban, director of development, 301.405.8289 or ngmarban@eng.umd.edu

Greg Moores '80

Ron Lowman '67

In Memoriam

LOUIS ROBINSON JR., age 76, director of the Maryland Industrial Partnerships (MIPS) program, died on November 10, 2002. In 1987, the Engineering Research Center recruited Robinson as associate director to develop an industrial partnership program. In 1990, he was appointed director of MIPS, which finances technical research for companies of all sizes throughout Maryland and links companies to faculty members in the University of Maryland system.

Under his directorship, the program has provided more than $20 million for collaborative research with more than 300 companies, including Bethlehem Steel, Black & Decker, Mack Trucks and Hughes Network Systems.

Prior to joining Maryland, Robinson served on the staff of Lehigh University in Bethlehem, PA, where he founded the Ben Franklin Incubator Center for the state of Pennsylvania.

He received his bachelor's degree in engineering from Johns Hopkins University.

RALPH A. SIMMONS, age 75, died on October 17, 2002. Simmons retired from the National Bureau of Standards in 1975 as an assistant director of the Center for Computer Science and Technology. He began his career as a civil engineer with the Pennsylvania Railroad. In 1951, he joined the Army's Transportation Intelligence Agency and later served as chief of the management support division at the Defense Intelligence Agency. He also served as chief of the office of computer engineering services at the National Library of Medicine. He received his B.S. in Civil Engineering in 1949.

W. TRAVIS WALTON, age 68, director of the university's Maryland Technology Initiative Program and founding director of the university's groundbreaking Technology Extension Service (TES), died on October 16, 2002.

In 1984, Walton, who had worked as an engineer in the space industry, joined the College Park TES, a regional industrial extension program launched that year to help small and mid-size Maryland manufacturers adapt to new technology and boost production. The program served as a national model for technology transfer.

He was also a co-founder of the American Industrial Extension Alliance and the Manufacturer's Assistance Focus, which disseminates information to manufacturers.

A member of numerous professional societies, Walton received bachelor degrees in engineering and electrical engineering from Rice University.

Forward Thinking

Charles A. "Chuck" Irish, Sr. has played an instrumental role in the life of the University of Maryland and in the growth of the Whiting-Turner Contracting Company. His affection and affiliations with both institutions run deep.

PHOTO BY LUISA DIPIETRO

Chuck joined Whiting-Turner in 1953, just one year after he received his bachelor of science degree in civil engineering from Maryland. At that time, Whiting-Turner was a small, local general contractor. Today, it is the largest privately held firm and the largest commercial construction firm in the Baltimore area with a prominent client list that includes Baltimore's National Aquarium, Joseph Myerhoff Symphony Hall, Harbor Place and Convention Center, and Virginia's Tysons Corner Shopping Center, to name but a few.

Respected as a supervisor and admired as a person, Chuck's leadership skills and engineering acumen have been critical to the success of the company. As Whiting-Turner's executive vice president, Chuck reports directly to company President Willard Hackerman, and directs the firm's entire operation throughout the United States. While his projects serve as models for speed, cost effectiveness, and quality workmanship, for Chuck, "working for a man like Willard Hackerman, and the ethical practices and the integrity of this company is what keeps me going."

Chuck is a life member of the American Society of Civil Engineers, and a member of the Engineers' Club and the Baltimore Building Congress and Exchange. In 1992, he received the University of Maryland's distinguished engineering alumnus award. Today, he serves as a member of the school of engineering's Board of Visitors, a role model of a major university donor, and an advocate of the university's programs, students and graduates.

Chuck explains, "I have been very lucky. I am blessed with a wonderful family. My wife, Norma, and I have been married for over 50 years. We have four children, two who have gone to Maryland, and nine grandchildren. Working for Whiting-Turner has been a great opportunity, and my education at Maryland was a good choice for me. I feel privileged to give back in some way."

Throughout the years, Chuck has helped to secure numerous gifts from his company in support of engineering and other university programs. Eight years ago, Chuck spearheaded the funding for the Whiting-Turner Business and Entrepreneurial Lecture Series, which brings influential alumni and friends to campus to share their experiences with students. "There is a symbiotic relationship between industry and a university. Strengthening one strengthens the other," he adds.

Chuck served in the Navy towards the end of World War II, and was later able to attend the University of Maryland on the GI Bill. "Financial support made a quality education possible for me," says Chuck. With this in mind, in 1997, he donated a townhouse, which was previously used as rental property, to the university. The proceeds from the sale of the townhouse were used to endow the Charles A. Irish Scholarship in Civil Engineering. "This gift, he explains, ensures a talented student who needs financial aid to receive a good education will have the funds available." More recently, in 2001, Chuck established a Charitable Remainder Trust, which will provide additional funds to the scholarship endowment and discretionary funds for the Dean of the School of Engineering.

In 1999, Whiting-Turner President Willard Hackerman honored Chuck's distinguished career by establishing an endowment to support an eminent professorship in the department of civil engineering. Recently, Whiting-Turner made yet another gift to the Clark School in Chuck's honor to support the new Kim Engineering Building by naming a laboratory in his honor—a fitting tribute to a devoted alumnus who has spent much of his life supporting engineering education and research.

To learn more about charitable Remainder unitrusts 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

Kim Building Adds New Dimension to Clark School

By 2005, the Jeong H. Kim Engineering and Applied Sciences Building, currently under construction on the site of parking lot G3, will become the Clark School's newest state-of-the-art facility.

Clark Construction, one of the nation's most experienced and respected general contractors headquartered in Bethesda, Md., will complete the 160,000 square-foot building that will house some of the most sophisticated engineering research and educational laboratories in the nation. A shared facility among several institutes, centers and engineering disciplines, it will foster an atmosphere that encourages cross-disciplinary collaboration to its fullest potential.

The building is named in honor of alumnus and Professor of the Practice Jeong H. Kim, who received the university's first Ph.D. in reliability engineering in 1991 and has contributed generously to the Clark School.

While the state of Maryland and the university have contributed significant resources to the construction and purchase of equipment, additional private support is needed. Gifts of any kind are welcome and numerous opportunities exist to name research and instructional laboratories, classrooms and the like, in honor of individuals or corporations. Visit our web site at www.eng.umd.edu/giving for more information on giving opportunities.

The "Virtual" Groundbreaking Ceremony is Wednesday, May 14—Join Us!
For more information visit our web site: www.eng.umd.edu/kim

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