MEMS TECHNOLOGY CREATES PERSONAL NAVIGATION DEVICE FOR DEFENSE DEPARTMENT
With the fall leaves changing color and another academic year at Carnegie Mellon upon us, this latest edition of iNEWS is loaded with new stories to report. There are new research projects, new 2008-9 Dowd Fellows, and several recent awards to celebrate. Two new centers have sprouted under the ICES umbrella. The Center for Implantable Medical Microsystems (CIMM) focuses on sensing and stimulation Microsystems that are ultra-miniature, ultra-low power and largely or completely biodegradable, with a goal of “near-zero” invasive implantable systems. The NSF/EPA Center for Environmental Implications of Nanotechnology (CEINT), just awarded this September, has as its mission to understand nanoparticle behavior to assess concerns regarding their environmental implications.

At the top of my list of announcements, I wish to remind our Carnegie Mellon readers that now is the time to nominate individuals for the 2008-2009 Steven J. Fenves Award given for a significant contribution to systems research in areas relevant to ICES. The deadline is November 24.

This past May, seven distinguished members from academia and industry convened on campus to participate in the ICES President’s Advisory Board meeting. The University President’s office runs this meeting roughly every five years to provide an external critical review of our institute. Thanks again to all of the faculty, staff and students who helped provide the Board with a comprehensive overview of our activities. The initial feedback received by the Board is very positive, reaffirming our mission and activities to engage faculty and students from across the university in interdepartmental research on engineered materials, devices, processes and systems. A key goal is to continue to nurture and expand research relationships with our industry partners.

The FY2009 project selection process for the Pennsylvania Infrastructure Technology Alliance (PITA) is underway. The Pennsylvania General Assembly, the Governor and the State Department of Community and Economic Development deserve our collective thanks for their continued support of this important program. In this round, ICES received 58 technical project proposals. Selection announcements are scheduled in December, with funding for most projects in place by January of next year. Even more near term is a series of short presentations on ongoing PITA research that is planned for the morning of November 6 as a lead into the PITA Industrial Advisory Board meeting. All are welcome to attend these morning presentations.

I’ve had several faculty members ask me “when is it appropriate to put proposals through ICES?” I felt it would be useful to answer this important question here, as perhaps many of you, even outside the University, may find this information helps illuminate how the institute works. While there is no single answer, there are some simple guidelines to consider. In general, a proposal should be administered through ICES if it’s part of a larger center or cluster activity that is promoted and fostered by ICES. Other suitable proposals are multidisciplinary with investigators from more than one department and promote core themes within ICES or will initiate a new thrust that falls within the scope of engineered materials, devices, processes and systems.

Why does this matter to you as a faculty member? As a critical mass of research volume grows in multidisciplinary areas, ICES can provide enhanced services such as executive center management, website creation and upkeep, external relations, event planning, major budget tracking forecasting, and purchasing. Amortized over the various research centers and clusters, these services add value to the faculty directly through specific work for their projects and indirectly by informing and networking colleagues and potential collaborators (for example, through PITA and iNEWS and events and “grass roots” meetings). Stop by, email or call me and I’ll be happy to discuss how ICES may be able to help your multidisciplinary research venture.

Please enjoy this latest edition of iNEWS and keep sending in your stories, comments and feedback! And, as always, I am interested in hearing your ideas and opportunities in the pursuit of ICES’ mission.

Gary K. Fedder
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A research team including faculty from ICES has received an award from the Defense Advanced Research Projects Agency (DARPA) to address the challenge of portable localization systems in GPS-compromised environments. (Page 1)

ICES used Pennsylvania Infrastructure Technology Alliance (PITA) funding to purchase Denford CNC microrouters for students in local school districts to design, build, and race their own scale model cars for the Formula 1 competition. (Page 5)
Guidance and navigation have been critical for military success since the dawn of civilization. Accuracy was the focus of earlier Department of Defense (DoD) navigation research, and led to the development of the Global Positioning System (GPS). The current focus in the DoD is the development of portable localization systems, particularly for GPS-denied or -compromised environments. These include mountainous or urban environments, situations in which there are dismounted soldiers, and with unmanned aerial vehicles.

A research team including faculty from ICES, the Electrical and Computer Engineering department, the Robotics Institute and the National Robotics Engineering Center (NREC) has received an award from the Defense Advanced Research Projects Agency (DARPA) to address this challenge. The team has been combining radio frequency (RF) velocity and range sensors with miniaturized microelectromechanical systems (MEMS) inertial measurement units (IMUs) to achieve superior navigation accuracy. This research includes the development and demonstration of such micro and nano scale low-power navigation sensors, MEMS IMU technology and integrated navigation systems techniques that allow long term (hours to days) GPS-denied precision navigation.

“This is an exciting vertically integrated research project that involves both sensor development of the MEMS and RF sensors as well as system integration to demonstrate the gains these sensors will enable for localization applications,” said Electrical and Computer Engineering Professor Tamal Mukherjee, who heads this research project.

As seen in the pictures on the following page, three kinds of shoe sensors are implanted in a shoe. The RF terrain-relative velocity (TRV) sensor mounted on the heel and toe is used for ZUPting the position computed from the accelerometers in the MEMS-based inertial measurement unit (IMU). The magnetometers in the IMU are used for ZUPting the heading computed from the gyroscope on the IMU. Shoe relative sensors (SRS) on one shoe form a constellation which can then be used to find the location of a moving shoe with respect to a stationary shoe. The team anticipates initial demos using the IMU and TRV sensor, with the SRS sensor used to meet the final project goal of accuracy down to 1 m after 10 hours in a GPS-denied environment. “This is a very challenging goal, one that took about a dozen years for GPS to get close to; we hope to get there in just 3 years” said Tamal Mukherjee.
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The primary focus of their research is applying personal navigation systems to a situation in which a soldier is dismounted. In this case, the navigation sensor is placed in the soldier's shoe or boot sole in order to determine his or her location with high accuracy. Other applications of this research include navigation for unmanned aerial vehicles (UAV), specifically the relative navigation for “flocks” of small UAVs, allowing them to navigate together without colliding like a flock of birds.

Shoe-Based Sensors: how They work

The team is building on a decade of research by ICES Director Gary Fedder and Mukherjee on chip-scale inertial sensors that meet the power and size requirements for portable applications. However, they suffer from a rapid growth in position error due to inherent bias drift and noise in the sensors. To limit this error growth, Fedder and Mukherjee are teaming with Electrical and Computer Engineering professors Dan Stancil and Jeyanandh Paramesh on developing a RF velocity sensor that detects when a shoe touches the ground. This is used for zero-updating (ZUPting) the navigation system that Robotics Institute professor and National Robotics Engineering Consortium researcher Alonzo Kelly is developing to bound this error growth.

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NEW ICES CENTER FOCUSES ON IMPLANTABLE MEDICAL MICROSYSTEMS

Microsystems technology has the potential to create revolutionary advances in implantable medical devices and to solve currently unmet conditions and improve outcomes for a multitude of medical applications such as cancer, hepatitis B & C, sudden cardiac death, HIV, epilepsy, diabetes, musculoskeletal disease, trauma, transplantation, obesity, resuscitation, spinal cord injury, and management of activity under extreme conditions.

It was with such potential in mind that a new center at ICES was formed: the Center for Implantable Medical Microsystems (CIMM). Under the direction of ICES Director Gary Fedder, the goal is to bring faculty members and students from multiple departments together, as well as establishing new and fostering existing partnerships with physicians, to create enabling technologies for the manufacture of implantable electronic sensing and stimulations systems. These systems would be ultra-miniature, ultra-low power, and largely or completely biodegradable. The vision of CIMM is to impact medical practice and quality of life through the use of these implantable Microsystems to allow for early diagnosis and precision intervention for the treatment of disease and trauma.

CIMM is the first entity dealing with implantable microsystems research to stimulate partnerships with the Pittsburgh medical community. The medical applications research that is motivating the initial research in CIMM includes bone regeneration; minimally invasive prostate thermo-surgery; brain electronic interface, consisting of wireless microsystems that allow for neural sensing and stimulation when normal motor function is impaired by amputation, trauma, or disease; and indwelling biochemical monitoring for disease detection and early therapy, specifically with cancer and heart disease.

Pittsburgh medical community partners include the West Penn Allegheny Health System, the University of Pittsburgh Medical Center, the VA Pittsburgh Healthcare System, and doctors from Allegheny General Hospital. CIMM faculty members include Gary Fedder, Jim Antaki, Phil Campbell, James Hoe, Xin Li, Ken Mai, Burak Ozdoganlar, Jeyanandh Paramesh, Todd Przybycien, Yoed Rabin, Alan Rosenbloom, Lee Weiss, among others.

NEW NANOTECHNOLOGY CENTER TO BECOME PART OF ICES

Associate Professor in Civil and Environmental Engineering Greg Lowry is pleased to announce that a new center has been created based on National Science Foundation (NSF) and U.S. Environmental Protection Agency (EPA) funding. The Center for Environmental Implications of Nanotechnology (CEINT, pronounced “saint”) is a joint center headquartered at Duke University under the direction of Mark Wisner, James L. Meriam Professor of Civil and
Executive Director of CenSCIR Matthew Sanfilippo says: “This research initiative will help to enable our nation’s natural gas infrastructure to be monitored by an active, real-time system, rather than a passive system that cannot react to changing conditions and defects. We hope to leverage promising research from other cyber-physical infrastructure domains and apply it to difficult natural gas pipeline maintenance and management issues.”

The nation’s natural gas pipelines consist of more than 1.4 million miles of transmission and distribution pipelines and bulk gas storage reservoirs. The team will create a research, development, and testing program to detect, identify, and prevent at an early stage, material defects, pipe faults, gas leakages, or major damage due to natural disasters or human attacks.

The project partners Concurrent Technologies Corporation, a national, independent non-profit organization and Carnegie Mellon University. The project will be performed under the oversight of DOE’s National Energy Technology Laboratory (NETL). Carnegie Mellon’s CenSCIR, housed within ICES, will conduct the engineering research required within the project, while CTC will provide logistical and technical input and oversight to the project.

**STEINBRENNER INSTITUTE JOINS THE ICES COMMUNITY**

As of July 2008, the Steinbrenner Institute has joined forces with ICES to leverage administrative resources and to explore research-related synergies, especially in regards to our respective corporate memberships.

The Steinbrenner Institute is led by Dr. David Dzombak, Faculty Director and the Walter J. Blenko, Sr. Professor of Environmental Engineering, and by Dr. Deborah Lange, Executive Director. Dave Dzombak explains the reason and benefits of affiliating with ICES this way: “Linking
Committed to building educational engineering opportunities for school students, ICES provided financial support for the 2008-2009 school year to two area Allegheny County schools to purchase equipment that will enable students to participate in the *Formula 1 in Schools Challenge* pre-engineering program. ICES used Pennsylvania Infrastructure Technology Alliance (PITA) funding to purchase Denford CNC microrouters for students in West Mifflin and Elizabeth Forward School Districts to design, build, and race their own scale model *Formula 1* cars. In addition, ICES purchased a Pitsco FasTrack racetrack to conduct the *Formula 1* competition once the CNC race cars are manufactured by the students. Each of the two schools also received a personal computer to run the microrouters.

The *Formula 1 in Schools Challenge* program engages students in a motivating learning experience focused on engineering design and manufacturing. The *F1* engineering design process requires students to use CAD (computer-aided design) software to create virtual 3-D models of the cars, which are manufactured using CNC rapid prototyping milling machines, or microrouters. *F1* student teams research, design, manufacture, and race scale model *F1* cars.

By purchasing the equipment for the *Formula 1* program, ICES supports its commitment to strengthening the S.T.E.M. (Science, Technology, Engineering, and Mathematics) educational pipeline, by addressing the critical workforce shortages in these areas.

The *Formula 1 program* supports a 2006 National Science Foundation (NSF) award to the PA State System of Higher Education (PASSHE) for *Advanced Manufacturing: Establishing Foundations for Education and Career Pathways from Middle School through College*. A specific focus of the program is recruitment and mentoring females and minorities into advanced manufacturing careers. The NSF project operates in two Pennsylvania regions: in southwest Allegheny County and in south-central Lancaster County. The educational partners in the southwestern Pennsylvania region include California University of Pennsylvania, Community College of Allegheny County, Steel Center Career and Technology High School, and five Allegheny County school districts: Brentwood, Elizabeth Forward, South Park, West Mifflin Area, and West Jefferson Hills. For more information on the NSF project, visit their web site: www.STEMsmartPA.com.

The NSF project in southwest Pennsylvania has been very successful with the *F1 in Schools Challenge*. In 2007, the South Park Middle School team (see picture on left), composed of two females and three males, competed at the state Technology Student Association (TSA) at Seven Springs in April. The South Park Middle School Team, the Screaming Eagles, placed second statewide and fourth at the national competition held in Nashville, Tennessee. In 2008, a team from South Park Middle School took first place at the statewide *F1* Competition at Seven Springs.

ICES anticipates the same excitement as *F1* pre-engineering design and modeling begins in West Mifflin and Elizabeth Forward School Districts this school year.
NSF PROVIDES FOLLOW-ON FUNDING FOR RESEARCH ON ADHESIVES

As follow-on funding of a PITA grant, Assistant Professor Metin Sitti received $300K grant from the National Science Foundation (NSF) related to his PITA research on “Nanomechanics of Biologically Inspired Repeatable and Hierarchical Elastomer Fibrillar Adhesives.” This work addresses the modeling, designing, and fabrication of hierarchical micro- and nano-fibers similar to gecko foot-hairs for creating novel repeatable fibrillar adhesives. These fibers are similar to gecko foot-hairs, which create a large collective surface area of contact, possessing physical properties that allow them to bend and conform to a wide variety of surface textures. Bayer MaterialScience LLC is supporting this work by providing custom polyurethane material development for optimized fiber adhesive properties and processing. The design of these fibers will allow for the creation of a new synthetic dry adhesive with numerous applications.

HOW I SPENT MY SUMMER VACATION: PITA-FUNDED GRADUATE GAS SENSOR RESEARCH

Ariel Virshup, a graduate student in the Department of Materials Science and Engineering (MSE), presented PITA-related research this summer at the Electronic Materials Conference in Santa Barbara, CA on June 26, 2008. The title of her talk was “Investigation of Thermal Stability and Degradation Mechanisms in Ni-based Ohmic Contacts to n-type SiC for High Temperature Gas Sensors.” Virshup, who is partially supported by her advisor MSE Professor Lisa Porter’s PITA grant on “Silicon Carbide-Based High-Temperature Electronics and Sensors,” also completed a 12-week internship at NASA Glenn Research Center in Cleveland, OH over the summer months. The work consisted of fabricating ohmic contacts for electrical testing at high temperatures for harsh environment applications that include gas and pressure sensing in aeronautic and automobile combustion engines.

COLLABORATION ON ENERGY EMISSIONS PITA-FUNDED RESEARCH

Pennsylvania enacted an alternative energy portfolio standard in 2004 (amended in 2007) that requires 8% of the electricity supplied by 2020 in Pennsylvania to come from solar photovoltaic energy, solar-thermal energy, wind, low-impact hydroelectric power, geothermal, biomass, biologically-derived methane gas, coal-mine methane or fuel cells. However, where significant hydroelectric storage is not available (or during drought years, or in states such as Pennsylvania with little hydro), combustion plants with fast ramping capabilities will be required to ensure a steady and stable supply of electricity until and unless very large cost breakthroughs are made in energy storage systems.

When combustion plants are used to provide compensating power, they will be forced to produce power over a larger power range. A pertinent question then is what happens to the emissions of a heavily-cycled natural-gas turbine. To find an answer to this question Executive Director of the Electricity Industry Center Jay Apt and his research team received PITA funding to create a model based on highly time-resolved emissions data from two natural-gas turbines.

Since receiving funding, Apt and his team have started collaboration with KEMA and the National Energy Technology Laboratory (NETL) to more extensively examine the effects of wind power on the emissions of the electricity grid. They also have a publication based on this research that is now in review.
LINCS DIRECTOR HOSTS INTERNATIONAL WEARABLE COMPUTING SYMPOSIUM IN PITTSBURGH

This fall, Pittsburgh will play host to the 12th IEEE International Symposium on Wearable Computing (ISWE), and ICES faculty members are organizing the event. ICES Research Professor and LINCS Director Asim Smailagic is the General Chair, and both he and Human-Computer Interaction Institute (HCII) Director Daniel Siewiorek are instrumental in leading this year’s organizational committee to plan the event, which will be held at the Sheraton Station Square Hotel from September 28 through October 1.

ICES Research Professor and LINCS Director Asim Smailagic.  (Top of page) The logo for this year’s IEEE symposium.

The annual ISWC symposium is the premier forum for wearable computing. It brings together researchers, product vendors, fashion designers, textile manufacturers, users, and related professionals to share information and advances in wearable computing. This year’s research presentation theme is focused on cell phones as wearable computers, as well as research dealing with more general wearable system applications, hardware and software, and considering the human factor in wearable computing.

Dr. Smailagic has played a strong role in the activities of the Institute of Electrical and Electronics Engineers (IEEE). After this year’s conference, his next role will be as Program Committee Co-Chair of the First International Symposium on Quality of Life Technologies, in June 2009 in Pittsburgh; an event which was initiated by the new NSF Engineering Research Center he is involved with on Quality of Life Technologies. Dr. Smailagic’s past involvement with IEEE conferences has included acting as Chair of the IEEE Technical Committee on Wearable Information Systems, Program Committee Co-Chair of the IEEE Symposium on VLSI, 2008, in Montpellier, France and acting as Program Committee Chair or Co-Chair of IEEE conferences over ten times in the previous years. In addition, he has held editorship roles in archival journals, such as IEEE Transactions on Parallel and Distributed Systems, IEEE Transactions on Mobile Computing, IEEE Transactions on Computers, IEEE Journal on Special Areas of Communications.

Much of the work that Professors Smailagic and Siewiorek have conducted through the Laboratory for Interactive Real-Time Computing Systems (LINCS), a research center within ICES, has become cornerstones of the wearable computing field. The work of LINCS has been a collaboration effort in designing and prototyping more than 30 generations of wearable computers.

For more information on this year’s IEEE International Symposium on Wearable Computing or on LINCS, please contact Dr. Smailagic at asim@cs.cmu.edu.
ENGINEERING PROFESSOR TO ATTEND NATIONAL ACADEMY OF SCIENCE SYMPOSIUM

Dr. Mohammad Islam has been invited to attend the National Academy of Science’s 20th Annual Kavli Frontier of Science Symposium to be held at the academy’s Arnold and Mabel Beckman Center in Irvine, CA in November. Dr. Islam is assistant professor of chemical engineering and of materials science and engineering. The intention of these symposia is to bring together some of the best young scientists to discuss advances and opportunities in their fields in a format that encourages informal collective as well as one-on-one discussions among participants. The academy began organizing these annual symposia in 1989.

THE ICES CONNECTION: TISSUE ENGINEERING COLLABORATIVE RESEARCH

Past and present members of ICES recently published an article on their collaborative tissue engineering research in the September issue of the journal Small. Authors included Mechanical Engineering and ICES postdoctoral fellow Amrinder S. Nain; Julie A. Phillippi, Assistant Professor of Mechanical Engineering and the Robotics Institute Metin Sitti; James MacKrell; ICES Research Professor Phil G. Campbell; and Cristina Amon. Phillippi, now an assistant research professor at the University of Pittsburgh Medical Center (UPMC), was previously a postdoctoral fellow of Dr. Campbell’s; Amon, now the Dean, Faculty of Applied Science and Engineering, is a former director of ICES.

Their article addresses how to control cell behavior by engineering biomaterial scaffolds at different hierarchical levels. The research team uses a fabrication technique known as “STEP”, Spinneret-based Tunable Engineered Parameters, which offers flexibility and control in fabrication and assembly of single and multi-layer fibrous scaffolds having diameters ranging from sub-50 nm to microns and several millimeters in length. Cells are observed to align along the fiber axis and make right angle transitions in the vicinity of topological constraints of parallel and perpendicularly intersecting fibers respectively. Upon encountering diverging fibers, cellular motion is observed to be thwarted. The fabrication of these fibrous scaffolds at extremely small (micro and nano) length scales opens new avenues in tissue engineering.

MEDIA ATTENTION ON SWALLOWABLE ROBOT

In its July 31 issue, the MIT Technology Review published an article on Metin Sitti, a professor and principal investigator of the NanoRobotics Lab, and his team’s work on a swallowable robot. The tiny capsule robot, which the article describes as “adhesive enough to anchor inside an intestine and yet gentle enough not to tear soft tissue,” promises to be a breakthrough for the medical industry. While swallowable cameras have been used for several years, this robot can be controlled, which means that it “would be good not only for snapping images, but also potentially for biopsies, drug delivery, heat treatment, and other treatment applications.”

ENGINEERING DESIGN COURSE FACULTY PRESENT AT ENGINEERING EDUCATION CONFERENCE

Former Product Design Course professor John Wesner and former course team leader Michael Bigrigg spoke on “The Effect of Project Definition on the Success of Student Team Design Projects” at the 2008 American Society for Engineering Education (ASEE) Conference and Exposition. The talk was the third in a series that have been presented over the last four years at the ASEE annual conference by faculty involved in the course. Initiated by former ICES Director Cristina Amon, who is an active member of ASEE, the talks have covered details of the ICES interdisciplinary engineering course.

Now taught by ICES Research Associate Professor Jeff Hansen, the course creates multidisciplinary student teams which carry out industry-sponsored design projects during a single semester. This year’s conference paper discussed the faculty’s findings. They determined that satisfaction of both students and industry sponsors can be increased by faculty working with sponsors to develop clear and concise project definitions that provide real opportunities for student creativity.
DOWD FELLOW SASHA BAKHRU AND TEAM WIN GLOBAL MOOT CORP® COMPETITION

Recently, 2007-2008 Dowd Fellow and Ph.D. biomedical engineering student Sasha Bakhru and his team “NeuroBank” won the 2008 Global Moot Corp® Competition*, winning a prize of $100,000 and ringing the opening bell at NASDAQ on August 15. Besides Bakhru, the team included Dr. Raymond Sekula, a neurosurgeon at Allegheny General Hospital and MBA student at Carnegie Mellon, and their advisors Biomedical Engineering Assistant Professor Stefan Zappe, David T. and Lindsay J. Morgenthaler Professor of Entrepreneurship S. Thomas Emerson, and Associate Professor of Management Communication Thomas Hajduk. The team members won with a business plan based on their research, reflecting the commercial potential of banking a person’s own neural stem cells for later treatment of neurological diseases.

The team originated through Sasha Bakhru’s enrollment in a Carnegie Mellon biomedical engineering course, Surgery for Engineers, in which students were paired with practicing surgeons. Bakhru was paired with Dr. Sekula, who has an interest in neural stem cell-based therapies for neurodegenerative disorders, particularly Hunter syndrome, and together they have worked on new strategies for harvesting neural stem cells from the brains of living patients undergoing neurosurgical procedures, developing strategies for expanding these few harvestable stem cells into therapeutic quantities, and delivering these cells to the brain.

The team previously won a first place finish in life sciences at the Rice University Business Plan Competition, a national qualifying competition for the Global Moot Corp® Competition.

Bakhru’s work with Drs. Zappe and Sekula began as an exploratory project, but has since developed into the basis for his doctoral thesis, thanks to funding from The Philip and Marsha Dowd Engineering Seed Fund.

*Note: The reference to Moot Corp® is analogous to “Moot Court,” a competition for law students.

2008-2009 PHILIP L. & MARSHA DOWD-ICES FELLOWSHIP RECIPIENTS ANNOUNCED

This past June, Philip L. Dowd (B.S. Materials Science and Engineering, 1963) and ICES Director Gary K. Fedder announced the recipients of the 2008-2009 Philip L. and Marsha Dowd-ICES Fellowship. This year’s fellows include Yixuan “Sean” Chen of Electrical and Computer Engineering, Christine Costello of Civil and Environmental Engineering, Nilay Inoglu of Chemical Engineering, and Tony Kim of Mechanical Engineering. This fall, both the new fellows and the outgoing 2007-2008 fellows will present their research projects to the Carnegie Institute of Technology (CIT) community and to Philip and Marsha Dowd at the Dowd Fellowship Symposium.

Chen is working with Professor Yi Luo from Electrical and Computer Engineering on “Complex Engineered Chemical/Biological Sensing System based on Precisely Defined Conducting Polymer Nanowire Arrays.” Costello is working with Civil and Environmental Engineering Associate Professor H. Scott Matthews and Director of the Green Design Institute Michael Griffin on “Development of a Land Use Inventory and Metric for Life Cycle Assessment.” Inoglu is working with Assistant Professor of Chemical Engineering John Kitchin on “Tuning the Reactivity of Heteroatoms for the Conversion of CO₂ to Energy-Rich Molecules.” Finally, Kim is working with Professors William Messner and Philip LeDuc of Mechanical Engineering and of Mechanical Engineering and Biomedical Engineering, respectfully, on “Probing Cell Motility in Cancer Metastasis using Closed-Loop Microfluidic Controls.”

The Philip and Marsha Dowd Engineering Seed Fund was established in 2001 through a generous gift to the College of Engineering from Philip and Marsha Dowd. Initially, the program supported one Carnegie Mellon doctoral candidate per year, but through additional endowments, the Dowds generously expanded the program in 2005 to support four fellows every year.
This year’s fellows were selected based on the cutting-edge, innovative nature of their projects. These seed projects each exhibit a strong plan for obtaining future external funding and address current areas of direct strategic interest within ICES and the Carnegie Institute of Technology (CIT). All of the selected fellows have been performing graduate studies at Carnegie Mellon for less than four years.

OTHER RECENT AWARDS AND DISTINCTIONS

In April, Burcu Akinci, associate professor of civil and environmental engineering, received the prestigious 2008 CETI (Celebration of Engineering and Technology Innovation) Award from the FIATEC industry consortium for significant achievements in new and emerging technology research. Dr. Akinci received the award as an “Outstanding Early Career Researcher.”

Walter J. Blenko Sr. Professor of Civil and Environmental Engineering David Dzombak was elected this year to the National Academy of Engineering (NAE). The mission of the NAE is to promote the technological welfare of the nation by marshaling the knowledge and insight of eminent members of the engineering profession. Dr. Dzombak, who is the faculty director of the Steinbrenner Institute for Environmental Education and Research, will attend a gala celebration on October 5 at The National Academies in Washington, D.C.

This past spring, Computer Science Professor Christos Faloutsos, along with Machine Learning Ph.D. student Hanghang Tong (CMU), Carnegie Mellon alumni and IBM employee Spiros Papadimitriou, and IBM employee Philip Yu, won Best Paper Award at the 2008 SIAM Data Mining conference. Their paper, entitled “Proximity Tracking on Time-Evolving Bipartite Graphs,” focused on their work on social networks and specifically, on measuring the proximity of nodes as networks change over time. SIAM-DM is one of the top data mining conferences.

Early this year, Todd Przybycien became the new director of the ICES Bioengineering Technologies Cluster. Przybycien is also the head of and a professor in the Biomedical Engineering Department; he also holds a courtesy appointment as professor in Chemical Engineering.

Metin Sitti, associate professor of mechanical engineering, was elected as the Vice President of the Technical Activities of the IEEE Nanotechnology Council for two years. As of September 2008, Professor Sitti became the co-editor-in-chief of a new journal called *Journal of Micro/Nano-Mechatronics* published by Springer Publishers.
with ICES enables us to access a comprehensive administrative structure for support of interdisciplinary research. Deb Lange and I are both excited about joining forces with ICES to help advance the mission of the Steinbrenner Institute and expand environmental research at Carnegie Mellon.”

The Steinbrenner Institute for Environmental Education and Research was founded in 2004 to facilitate, promote and advance campus-wide educational, research, and practice initiatives related to the environment. As an independent and interdisciplinary organization, the Steinbrenner Institute represents 18 research centers at Carnegie Mellon that focus on environmental engineering, science, architecture, and policy. The Steinbrenner Institute works to coordinate efforts among the research centers to pursue new interdisciplinary opportunities. It also conducts a number of other initiatives including a corporate partnership program, a graduate fellowship program, a seed grant program, media fellowships, media workshops, and outreach to the campus community and beyond.

More information about the Steinbrenner Institute and its corporate partnership is available at www.cmu.edu/steinbrenner.

CM²EM OFFERS INTERDISCIPLINARY COLLABORATION

Since its establishment as an ICES center last winter, the Center for Multiscale Modeling for Engineering Materials (CM²EM) has been organizing events and soliciting funding in order to solidify its commitment to collaborative, interdisciplinary research among Carnegie Mellon engineering, science, and mathematics faculty. CM²EM was created to serve as a primary hub for materials modeling activity at Carnegie Mellon.

Widom says that even though “methods of modeling and simulation are shared in common across many branches of science and engineering, previously CMU had no forum in which practitioners could meet and share ideas.”

In May, CM²EM Director Amit Acharya and Associate Director Michael Widom hosted a retreat in May as a way to bring faculty together on a regular basis to discuss their research. Speakers included professors Alan McGaughey and Fred Higgs from Mechanical Engineering, Craig Maloney and Kaushik Dayal from Civil and Environmental Engineering, and Xin Li and Tony Rollett from Materials Science and Engineering. Outside speakers included Ed Krokosky from G.L. Wilson & Company, speaking on the challenges in characterizing construction materials, and Dennis Dimiduk from the Air Force Research Lab at the Wright-Patterson Air Force Base, discussing multiscale materials issues the Air Force faces in its application of metallic materials.

A regular method of collaboration with CM²EM members has been the bi-weekly seminars hosted by ICES. Each meeting has featured a center member discussing CM²EM-related research, including experimental measurements of 3D microstructure evolution (Robert Suter, Physics); continuum models of materials with microstructure (Noel Walkington, Mathematics); three-dimensional microstructural observation, analysis, and simulation challenges (Greg Rohrer, Materials Science & Engineering); the general theory of homogenization (Luc Tartar, Mathematics); optimized Monte Carlo simulations (Bob Swendsen, Physics); adhesion and friction experiments in microscale systems (Maarten DeBoer, Mechanical Engineering, and sequential scale transition in dynamics (Amit Acharya, Civil and Environmental Engineering).

CM²EM members have also been submitting large group proposals and Drs. Acharya and Widom are anticipating center-scale proposal opportunities in the near future. In addition, CM²EM members have had individual CM²EM-related research proposals funded, including CM²EM member Professor Suter who recently received a grant from the National Science Foundation for studies of grain growth in polycrystals.
The ICES-housed project “Computational Models and Algorithms for Enterprise-wide Optimization of Process Industries,” which is being partially funded by the Pennsylvania Infrastructure Technology Alliance (PITA), has continued with the participation of ABB, Air Products, BP Dow Chemical, ExxonMobil, NOVA Chemicals and Total. Recently, two new companies have joined the EWO group: PPG and Praxair. The representative of PPG is Dr. Yu Jiao, and the one from Praxair is Dr. Jose Pinto. Dr. Ricardo Lima will work with PPG on the planning and scheduling of a multiproduct continuous plant, while the Ph.D. student Fengqi You will be working on a distribution problem by Praxair.

The Enterprise-wide Optimization (EWO) project involves a total of 7 Ph.D. students, and 5 faculty (CMU: Biegler, Grossmann, Hooker; Lehigh: Snyder; UPitt: Schaeffer). A webpage describing this project, including seminar slides and meeting slides can be found in: http://egoncheme.cmu.edu/ewocop/. The membership fee to join this group is $12,500 for members of the CAPD. Companies interested in participating in this research program should contact grossmann@cmu.edu.

The last EWO meeting took place on March 12, 2008, right after the Annual CAPD Meeting on March 10-11. We had a special session EWO on March 11 that was well received. The presentations were by Professor Sebastian Engell, University of Dortmund; Professor Tom Marlin, McMaster University; and Dr. Sridhar Tayur, SmartOps. The review of EWO projects took place on March 12 in which there was also a fruitful discussion about best practices in this area. The next EWO meeting will take place on September 29-30, 2008.

feature update: ICES Professor Ender Finol receives further NIH funding

It was reported in the spring issue of iNews that Ender Finol had been recently awarded $385,812 in National Institutes of Health (NIH) funding for his Vascular Biomechanics and Biofluids Laboratory’s work on predicting the rupture potential of abdominal aortic aneurysms. Since then, he has received a second NIH grant, bringing NIH’s total funding of this research to $602K. Both grants are for two years.

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To read more about ICES, its current structure, research interests, projects, and people, please visit our newly redesigned website at http://www.ices.cmu.edu/.

Please feel free to contact our director, Gary Fedder, or use our on-line directory to identify contacts. We welcome your comments and your ideas.

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A SUCCESSFUL SUMMER FOR PITA-FUNDED ICES OUTREACH

This summer, SEE welcomed 19 middle school girls from area schools who spent two weeks in July participating in multidisciplinary engineering activities focused around the theme of creating efficient and environmentally friendly forms of energy. This year’s girls hailed from the Pittsburgh public schools, as well as schools in Wilkinsburg, Mount Lebanon, North Allegheny, and Woodland Hills.

The girls worked on hands-on activities and labs with participating engineering faculty, including Gary Fedder (ICES), Susan Finger (CEE), Annette Jacobson (CE), Rose Frollini (CE), Deanna Matthews (CEE), Bruno Sinopoli (ECE), Nisha Shukla (ICES), Jay Whitacre (MSE), Neil Donahue (Chemistry), and Engineering and Science Librarian Lynn Berard. The girls also visited Phipps Conservatory where they were treated to a behind the scenes tour of the production houses and Phipps’s eco-friendly practices. On the final day of the program, each girl presented her research on a related topic to fellow SEE participants, faculty and staff and parents.

The goal of the SEE program is to address the critical time in the lives of adolescent girls when they begin to lose momentum in pursuing math and science related interests in their educational and professional careers. The program coordinator and participating faculty are now exploring other funding to augment the initial seed funding provided by PITA in order to expand programmatic opportunities for participating girls as well as developing and instituting evaluation procedures of the program’s success.

This summer, ICES also hosted three Pennsylvania students who conducted research with engineering faculty participating in the SURE Thing program. For the last five years, the PITA-funded SURE Thing program has provided opportunities for non-Carnegie Mellon Pennsylvania engineering and science undergraduates to benefit from working with Carnegie Mellon faculty on research projects. This year’s students hailed from Villanova University, the University of Pittsburgh, and a local Pittsburgh student who attends Bethany College in West Virginia. Their research projects included studying the environmental performance of the Hamerschlag Hall green roof with Civil and Environmental Engineering professor Cliff Davidson; studying and creating a magnetic refrigerator with Physics professor Sara Majetich; and studying magnetic nanoparticles and polymer nanocomposites for applications in tissue engineering with Materials Science and Engineering professor Michael McHenry.