NU Engineer

2009

NORTHEASTERN UNIVERSITY

ENGINEERING CAPTURES 4th & 5th NATIONAL RESEARCH CENTERS

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FROM THE DEAN

Dear Friends,

I am pleased to present the 2009 issue of Northeastern University's *NU Engineer*, which provides a glimpse of the College and its accomplishments. The 2008–2009 academic year was stellar on several fronts. With the launch of the ALERT Center, and two new awards of the VOTERS Center and the NEHCEP Center, the College now leads five competitively awarded national research centers. The College continued to expand its faculty; over two years, the number of faculty members increased from 92 to 105 through the recruitment and hiring of outstanding teacher-scholars. Plans are to continue to expand, providing great career opportunities for ambitious scholars at all academic ranks. The College also grew in both the quality and size of its student body and developed three new degree programs that will launch this September.

The College's five national centers are funded by diverse federal agencies: the National Science Foundation (two), the Department of Homeland Security, the National Institute of Standards and Technology, and the Department of Veterans Affairs. In this issue, our lead article covers the NIST center charged with developing Versatile Onboard Traffic Embedded Roaming Sensors, which when realized will provide real-time state awareness of bridge and road infrastructure. A second article introduces the New England Healthcare Engineering Partnership, one of four Veterans Engineering Research Centers established across the nation that will bring systems and industrial engineering concepts, technologies, and solutions to Veterans Affairs hospitals.

In September 2009, two auspicious events will occur. The College will welcome its largest (in a long time) and academically strongest (ever) freshman class. The number of incoming freshmen represents an almost 25 percent increase from 2008. The College will also begin celebrating its Centennial Year. In 1909, an enterprising and innovative young dean, Hercules Geramanos, used the newly developed concept of cooperative education to launch a full-time engineering college. We believe the current articulation of that concept represents the best model of engineering education for the 21st century; our Centennial provides the opportunity to reintroduce this concept to the world.

Recognizing the large and central importance of bio- and biomedical engineering in the research programs of the College, we are launching MS and PhD programs in bioengineering with seven distinct tracks; we introduce the programs here and provide glimpses of four exciting and diverse bio-related research programs of our faculty. We are also launching the first professional MS in Energy Systems, which combines education in engineering, technology, finance, and policy aspects of energy for professionals who wish to move into leadership in the corporate and government sectors. Throughout this issue, you will find a celebration of our faculty: our PECASE recipient, Purnima Ratilal; our latest CAREER awardee, Luca Caracoglia; new members of our faculty; faculty members who received tenure and/or promotion; and a listing of awarded honors.

You will find these articles and much more in this issue. I hope you enjoy it. Please get back to me with any comments at dean@coe.neu.edu.

With kind regards,
David E. Luzzi
Dean, College of Engineering

inside '09

College of Engineering

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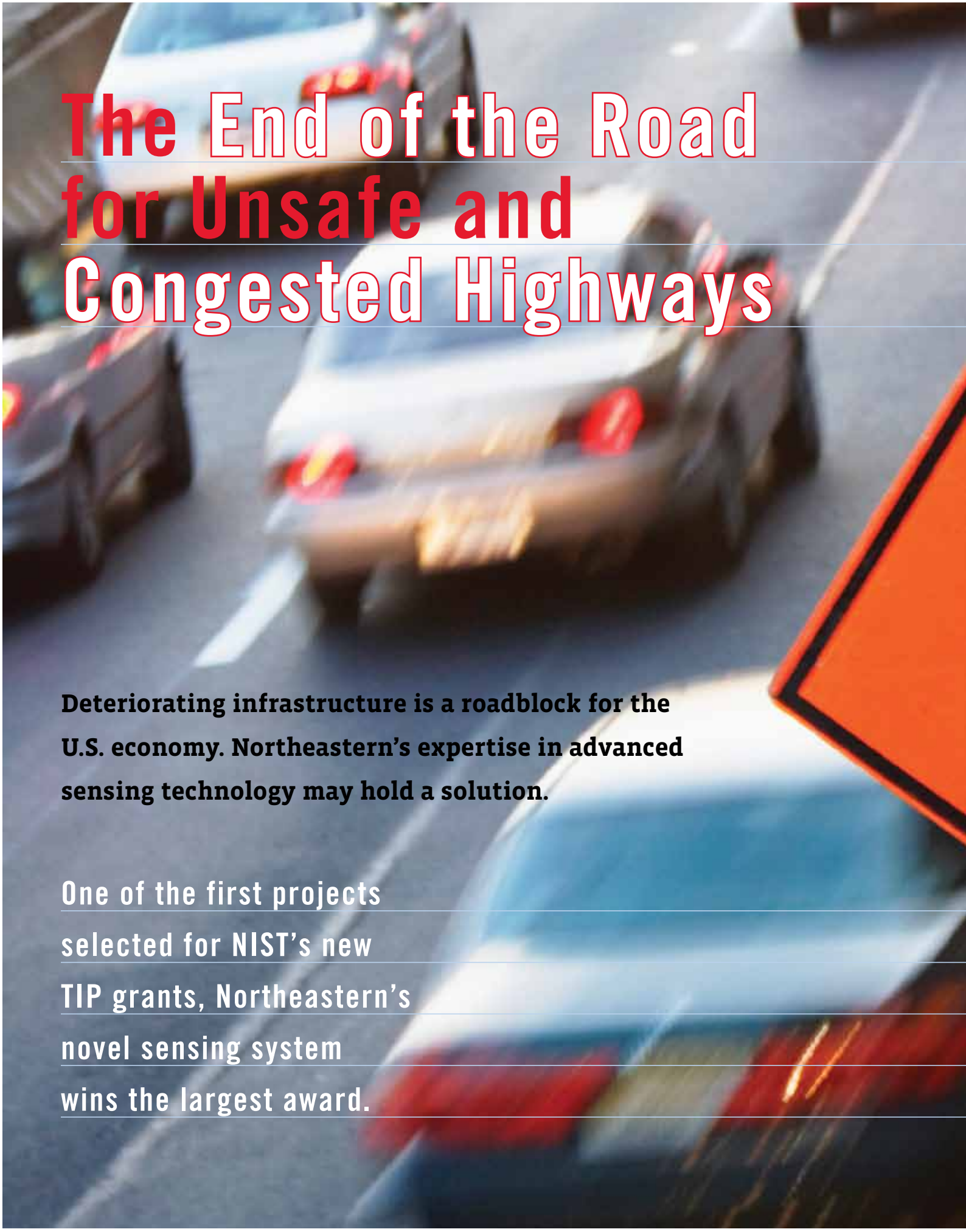
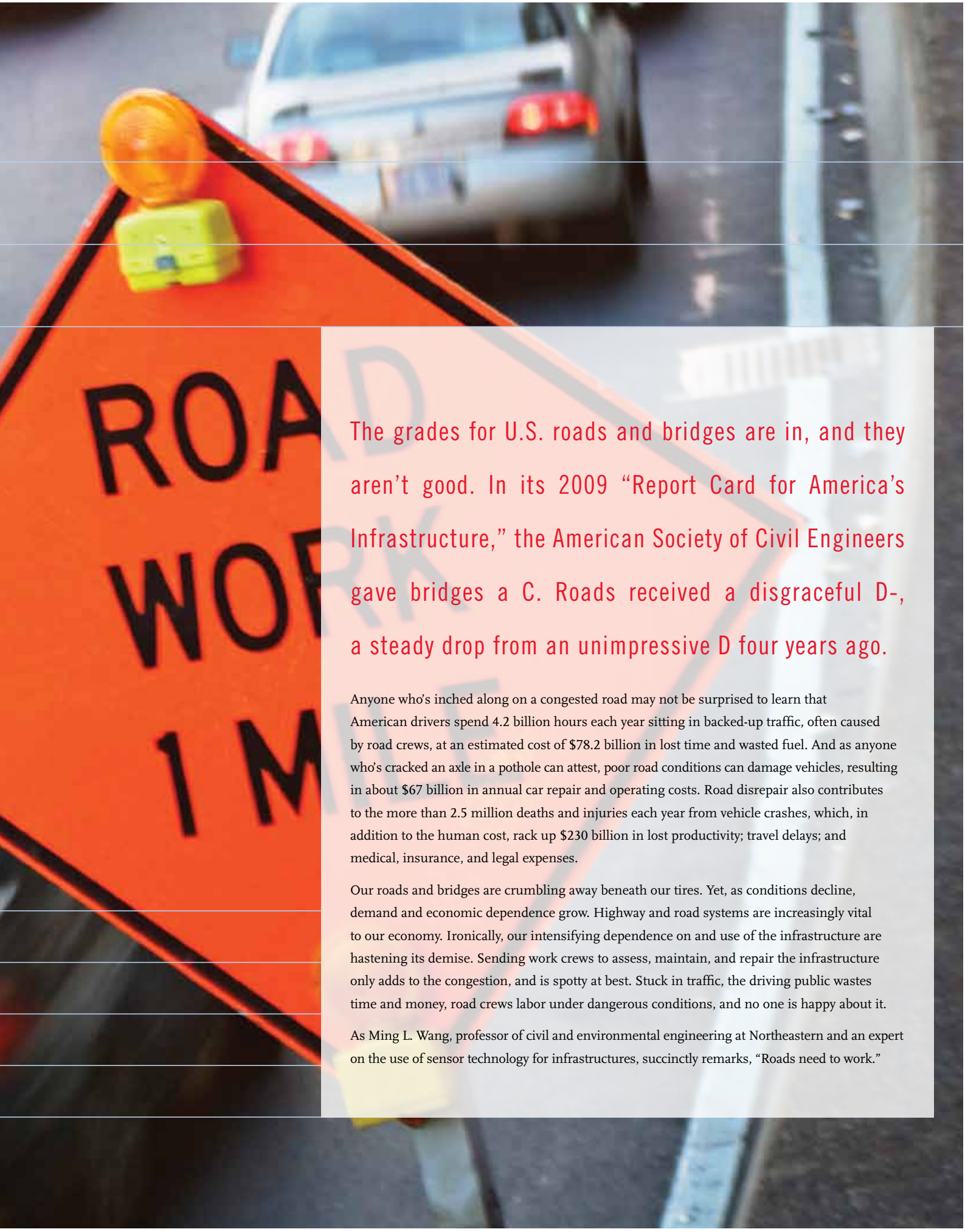


The End of the Road for Unsafe and Congested Highways

Deteriorating infrastructure is a roadblock for the U.S. economy. Northeastern's expertise in advanced sensing technology may hold a solution.

One of the first projects selected for NIST's new TIP grants, Northeastern's novel sensing system wins the largest award.



The grades for U.S. roads and bridges are in, and they aren't good. In its 2009 "Report Card for America's Infrastructure," the American Society of Civil Engineers gave bridges a C. Roads received a disgraceful D-, a steady drop from an unimpressive D four years ago.

Anyone who's inched along on a congested road may not be surprised to learn that American drivers spend 4.2 billion hours each year sitting in backed-up traffic, often caused by road crews, at an estimated cost of $78.2 billion in lost time and wasted fuel. And as anyone who's cracked an axle in a pothole can attest, poor road conditions can damage vehicles, resulting in about $67 billion in annual car repair and operating costs. Road disrepair also contributes to the more than 2.5 million deaths and injuries each year from vehicle crashes, which, in addition to the human cost, rack up $230 billion in lost productivity; travel delays; and medical, insurance, and legal expenses.

Our roads and bridges are crumbling away beneath our tires. Yet, as conditions decline, demand and economic dependence grow. Highway and road systems are increasingly vital to our economy. Ironically, our intensifying dependence on and use of the infrastructure are hastening its demise. Sending work crews to assess, maintain, and repair the infrastructure only adds to the congestion, and is spotty at best. Stuck in traffic, the driving public wastes time and money, road crews labor under dangerous conditions, and no one is happy about it.

As Ming L. Wang, professor of civil and environmental engineering at Northeastern and an expert on the use of sensor technology for infrastructures, succinctly remarks, "Roads need to work."

"We see a new industry, new jobs being created as a result of VOTERS. This innovative technology will address a major societal need and save billions of dollars in annual inspection costs. It will serve as a platform for future network-based sensing systems for maintenance, planning, and the security of our civil infrastructure." — PROFESSOR MING L. WANG

A new approach to an old problem

To that end, Wang and Sara J. Wadia-Fascetti, associate professor in Northeastern's Department of Civil and Environmental Engineering, are leading the effort as coprincipal investigators of the Versatile Onboard Traffic Embedded Roaming Sensors (VOTERS) project, which will develop affordable, cost-effective, nondisruptive methods of detecting surface and subsurface defects in roads and bridges.

Backed by a five-year, $9 million grant from the National Institute of Standards and Technology (NIST) Technology Innovation Program (TIP), the VOTERS team includes more than 30 faculty, research scientists, and graduate students from the fields of electrical, computer, and civil engineering. Joining Northeastern University, the lead research institution, as project partners are the University of Vermont, the University of Massachusetts Lowell, Analogic Corporation, Infrasense, Inc., and the Massachusetts Highway Department.

VOTERS will accomplish its mission without interrupting the flow of traffic, by essentially using traffic itself to monitor and assess conditions. The project team is developing a set of sensors that will attach to the undersides of vehicles driven at normal speeds and over usual routes. The sensors will relay collected data about infrastructure conditions to a central computer system, which will process the information and identify problem areas.

"VOTERS will change the way infrastructure is inspected and maintained," said Wadia-Fascetti. "It will transform the entire infrastructure assessment and maintenance industry." Currently, a city or state hires a contractor to survey and assess its roadways and bridges, requiring work sites that block traffic, add to congestion, and create potentially unsafe conditions for both drivers and inspection personnel. In addition, even if inspections are made regularly, conditions change frequently, and it would be more accurate to monitor infrastructure continuously.

Innovative technology, real-time data

The general concept of using sensors on moving vehicles has been around for a while, but the technology didn't exist. However, now, with proposed new research and advances, "the technologies are coming together," said Jeffrey Doughty, project manager for VOTERS.

The project addresses the challenges of developing high-risk, high-payoff sensing and computing technologies as well as lightweight, relatively inexpensive hardware that won't interfere with the host vehicle or the flow of traffic. The intention is for the system to be autonomous, with no additional effort required of the driver and minimal human involvement in reading the collected data.

The VOTERS team is working on three sensors that will require new developments in existing radar technologies and a completely novel acoustic method.

Surface Looking Millimeter-Wave Radar (SLiMR) will make inspections near the surface of reinforced concrete pavement, using commercial off-the-shelf COTS 77 GHz radar. Similar sensors are in current use in upscale automobiles as parking guides and collision-avoidance systems. "We will essentially take that and point it downward," Wadia-Fascetti explained.

In addition to SLiMR, Gigahertz Electromagnetic Array Roaming Sensors (GEARS) will use an advance in air-coupled ground-penetrating radar (GPR) yet to be developed to detect such subsurface defects as delaminations, trapped moisture, and rebar corrosion. Although GPR is already used for inspections, current equipment is large and bulky and needs to be towed behind a vehicle or pushed by hand. VOTERS intends to develop a much smaller, lightweight component that can be mounted beneath a vehicle and operate accurately at normal travel speeds.

"We're leveraging the wealth of experience developed from Gordon-CenSSIS," said Carey M. Rappaport, professor of electrical and computer engineering, associate director of Northeastern's National Science Foundation–supported Bernard M. Gordon Center for Subsurface Sensing and Imaging Systems (Gordon-CenSSIS), and head of the VOTERS radar efforts. "We are applying advanced methods of noninvasive underground detection and interpretation to this very practical, very important problem."

The third sensor, a Tire Excited Acoustic Sensor (TEASe), will be not only new hardware, but also new technology. TEASe will be a wave-based sensor that will analyze the tire noise generated in normal driving to acousti-

cally identify defects in asphalt overlay and concrete roadbeds. "This enables all vehicles to become road-quality sensors; therefore, road defects can be detected without stopping traffic," said Wang.

Using a Global Positioning System coupled with video to be developed under the leadership of Octavia Camps, professor of electrical and computer engineering at Northeastern, VOTERS will be able to pinpoint the location of a needed repair, not just what road but what lane, and where in the lane. The VOTERS team hopes to design technology that is as accurate as one centimeter in locating a defect.

Signal processing strategies

The team envisions the user agencies deploying VOTERS on hundreds of vehicles driven in their regular daily use, over their normal routes, and at their normal speeds. The research will determine what the best type of vehicle is—bus, van, truck, or automobile—both for the sensors and for the widest range of surface coverage. Buses, for example, may prove to work well with the technology but only provide data from the right lane.

Using many vehicles passing over the same areas would allow the system to collect multiple data on the same features. The discovery of an anomaly by one vehicle would be corroborated, or not, by others. Such redundancy would verify the data and prevent a repair crew being sent out unnecessarily by a faulty reading.

VOTERS will require new signal-processing methods. Deploying hundreds of sensing units will generate an overwhelming amount of information that requires the development of onboard data-reducing algorithms based on individual and fused data sets. Important data will be transferred via the cellular phone network to a back-end geospatial database that will buffer and store it. Road status compiled from the deployed sensors will be shown on a central electronic Management and Prognosis (MAP) system.

Some onboard processing will also be necessary to manage the sheer volume of data. To meet this need, the VOTERS team will develop the Broad Overseer Sensing System (BOSS), computer software designed to process and register data on board as well as control each sensing component.

Doughty points out that current radar evaluation is done by humans, who perform the post-process tasks. "Our goal is to have the VOTERS system run itself, making many judgments without humans. Of course, people will be involved in the final analysis."

Upping the intelligent highway's IQ

VOTERS, as Wang explains, is a good conceptual fit with the federal Intelligent Transportation Systems (ITS) program established in 1991 under the Intermodal Surface Transportation Efficiency Act. The goal of ITS is to use advanced technology on vehicles and in infrastructure to solve the problems of traffic congestion and safety and, by doing so, improve U.S. productivity.

VOTERS components can be used as planned, as well as for alternate uses related to ITS. "For example," Wang said, "our sensors will monitor location and speed of the host vehicles, so there is the potential for real-time traffic monitoring that could be transmitted to interactive road-condition signs."

While the team anticipates that the initial purchasers of the first commercially available VOTERS systems will be government agencies, other entities such as airports could use it to monitor their asphalt and concrete structures. The team plans to produce a viable prototype within five years. The technology will transition from research project to commercial use and will be available to corporations to build and sell.

"The 21st century will witness the installation and use of engineering systems that provide detailed 'state awareness' of complex systems that realize major improvements in efficiencies and reliabilities," remarked David E. Luzzi, dean of the College of Engineering. "Professor Wang and our VOTERS team bring Northeastern's interdisciplinary, multi-institutional, translational research approach to the complex challenge of infrastructure management. I expect great benefits for society from the efforts of our outstanding faculty and students."

"We see a new industry, new jobs being created as a result of VOTERS," said Wang. "This innovative technology will address a major societal need and save billions of dollars in annual inspection costs. It will serve as a platform for future network-based sensing systems for maintenance, planning, and the security of our civil infrastructure."

Improving Healthcare for Veterans

Northeastern Leads Multiuniversity Partnership with Veterans Affairs

A new healthcare systems engineering center has been established partnering Northeastern University's healthcare industrial engineering program with New England Veterans Affairs (VA), the Massachusetts Institute of Technology, Worcester Polytechnic Institute, and several VA centers of excellence. The partnership will develop and implement innovative industrial engineering solutions to dramatically improve process quality, access, safety, efficiency, and performance throughout the VA healthcare system, as well as New England and U.S. healthcare processes more broadly.

Supported initially by $3.4 million annually from the U.S. Department of Veterans Affairs in grants and matching funding, the New England Healthcare Engineering Partnership (NEHCEP) is one of four new national Veterans Engineering Research Centers created in July 2009 that together represent the single largest investment in healthcare process improvement in the U.S.

"There is an urgent need to improve patient safety and healthcare delivery across the U.S. and worldwide, and this unique healthcare-engineering partnership is designed to provide an approach that will significantly improve healthcare systems through engineering-based solutions," said Professor James Benneyan, NEHCEP executive director and professor of industrial and mechanical engineering at Northeastern.

NEHCEP's mission and strategy are (1) to develop and apply systems engineering methods similar to those used successfully in other industries to create highly efficient, safe, effective, and reliable processes; (2) to solve immediate urgent system issues as they arise; and (3) to build long-term systems engineering improvement capabilities both internally at VA and through a network of external partners. Developing this ability to continually improve clinical and operational processes will be especially important as new needs develop and as the healthcare needs of veterans change over time.

"Our vision is to do for healthcare what the Toyota Production System, Six Sigma Quality, and industrial engineering methods did for the automobile, electronics, and other industries," said Benneyan. "By leveraging the broad expertise of VA, academic partners, and healthcare improvement experts, over time we will embed engineering improvement methods, principles, and capabilities into the fabric of the VA healthcare system. The center's projects and educational programs will cross-educate future engineers and healthcare professionals so that they can work effectively together to improve healthcare."

Added Dr. Michael Mayo-Smith, network director of the VA New England Healthcare System, **"Through these integrated efforts, we expect nothing less than to build a pervasive culture of improvement that will engage all of our staff, from top to bottom, in this fundamentally important work."**

Located within the Boston VA Healthcare System, NEHCEP will serve the entire New England network of 8 medical centers and 37 community-based outpatient clinics, which together provide care to some 1.2 million veterans. VA already has one of the best healthcare systems in the U.S., and the vision of the four new centers is to help lead the U.S. in improving healthcare processes, increasing access, and reducing costs.

In addition to conventional industrial engineering methods, NEHCEP will use advanced mathematical and computer modeling methods to analyze, improve, and optimize processes. In other industries, these methods are employed to enhance product flow, increase efficiency, improve quality, and reduce costs; they can be used to tackle similar issues in healthcare, such as access, waits and delays, safety, optimal care, efficiency, equity, and effectiveness, the top healthcare priorities recently identified by the Institute of Medicine and the National Academy of Engineering.

Professor James Benneyan

"As the largest healthcare system in the U.S. and one with deep leadership commitment, VA is an ideal environment for developing, demonstrating, and disseminating healthcare engineering solutions nationwide," added Benneyan. Known for more than 20 years of work in healthcare systems engineering, Benneyan is a fellow at the Institute of Healthcare Improvement, the founder of Northeastern's Quality and Productivity Healthcare Research Lab, a former senior systems engineer at Harvard Community Health Plan, vice president of the Institute of Industrial Engineers, and past president of the Society for Health Systems.

Several new academic programs will be created to develop a future workforce skilled in both engineering improvement methods and healthcare systems. For Northeastern students, this will include the creation of new co-op positions and undergraduate senior projects with VA and other Boston-area hospital partners; undergraduate and graduate courses; a healthcare industrial engineering minor; graduate applied research projects; and eventually a professional master's degree program. To accomplish this vision, the center also will focus on leveraging its resources and other partnerships to develop additional funding for methods research, professional development, and educational programs.

PECASE Recognizes Exceptional Potential

COE Faculty Member Purnima Ratilal Receives Prestigious Award

College of Engineering faculty member Purnima Ratilal is the recipient of a Presidential Early Career Award for Scientists and Engineers (PECASE), considered the highest honor bestowed by the U.S. government on outstanding scientists and engineers beginning their independent careers. The award is intended to recognize those who "show exceptional potential for leadership at the frontier of scientific knowledge during the 21st century."

An assistant professor in electrical and computer engineering, Ratilal was selected by the U.S. Department of Defense for this award. She will receive $200,000 per year for five years in support of her research.

Ratilal was 1 of 67 scholars chosen by nine federal departments and agencies. She and other recipients were honored at a December 19, 2008, White House ceremony led by John H. Marburger III, then science advisor to the president and director of the White House Office of Science and Technology Policy.

"To receive the award is a dream come true," Ratilal said. "It is a very prestigious award for young faculty, and when I heard about it, I was overjoyed beyond words."

Ratilal's research focuses on exploring acoustic, seismic, and ultrasound remote sensing in the ocean for military, ecology, and commercial applications. Current projects include a remote acoustic sensing system for rapidly imaging and localizing schools of fish and other biology over areas spanning thousands of square kilometers in near real time, and an "extinction theorem" used to design an acoustic "burglar alarm" or "trip-wire" system for detecting submerged objects. Such projects are useful to both regulatory agencies and fishermen, as well as to the Office of Naval Research, whose officers have difficulty differentiating various underwater objects.

Professor Purnima Ratilal at the White House

"Fish are the main cause of false alarms or clutter for the Navy," Ratilal said, noting that the military branch is interested in developing signal processing and tactical approaches for classifying objects in the ocean. One way to accomplish this is to use acoustic color, which discerns targets with an acoustic sensing system based on their scattering response as a function of frequency.

Ratilal's mentor, electrical and computer engineering professor Carey Rappaport, noted that the PECASE award distinguishes her as one of the world's experts on using and processing sonar data in the ocean. "Whenever the president of the United States hands out an award," he said, "it puts the recipient in the upper echelon of achievement. For a Northeastern faculty member to be represented among the winners is pretty fantastic."

Funding from the Department of Defense will go toward hiring undergraduate and graduate students, and postdoctoral associates, as well as for conducting research analysis and experiments, Ratilal said.

Winslow Sargeant, E86 Our Man in Washington

Winslow Sargeant, a 1986 graduate in electrical engineering from the Northeastern University College of Engineering and 2003 recipient of the Northeastern University Outstanding Engineering Alumnus Award, has been nominated by President Obama as the chief counsel for advocacy, U.S. Small Business Administration.

Winslow Sargeant

If confirmed, Sargeant will assume the new government post following an accomplished career in both government and the private sector. He has been a managing director in the technology practice at Venture Investors since 2006. From 2001 to 2005, he was the program manager for the Small Business Innovations Research (SBIR) Program in Electronics, a new office in the National Science Foundation's Engineering Directorate. Previously, he cofounded Aanetcom, a start-up semiconductor chip company, following senior engineering positions at Lucent, AT&T Bell Labs, and IBM.

Sargeant currently serves on several boards, including those of Silatronix and Pattern Insight and for a number of nonprofit and education organizations. He is a member of the advisory board of the National Science Foundation's Industrial Innovation and Partnership Division. He earned an MS from Iowa State University and a PhD from the University of Wisconsin, both in electrical engineering. He was a member of the 11th class of Kauffman Fellows, a program that identifies, develops, and networks the next generation of global leaders in the venture capital industry. Sargeant currently serves on the Northeastern University Board of Governance as a member of the Corporation.

Bioengineering Doctorate

Where Biology and Engineering Meet

The interface of biology and engineering offers one of the most dynamic and important areas for interdisciplinary research. To take advantage of and expand upon the interdisciplinary and translational research in biology, engineering, and related disciplines conducted at Northeastern University, the College of Engineering (COE) offers a new PhD degree program in bioengineering beginning fall 2009. Some 91 faculty from COE, Arts and Sciences, and Bouvé College of Health Sciences will be affiliated with the program.

Tracks or areas of concentration will be available in bioimaging and signal processing; biomechanics and mechanobiology; bioMEMs/BioNano; biochemical/bioenvironmental engineering; motor control; and biocomputing. An unrestricted but guided track will also be available. This system provides flexibility, as tracks may be added or removed depending on evolving strengths in the College of Engineering and across the University.

The students who pursue this degree will possess varying engineering backgrounds. They will acquire sufficient breadth of knowledge and fluency to interact with clinicians and life-science researchers, as well as enough depth of knowledge to perform quantitative bioengineering research as independent investigators in the most original and innovative areas of inquiry.

According to Jeff Ruberti, associate professor of mechanical and industrial engineering and program director, "In designing the program, we examined the strengths of Northeastern, determined what a 'bioengineer' should be, and added significant value to the scaffolding that was already in place. We have no doubt that students who graduate from the program will be well prepared to compete for the top academic appointments and industry positions available."

Gordon Engineering Leadership Program

Pioneering Graduates Reach Important Milestones

The Gordon Engineering Leadership Program was established in 2007 through a major gift from the Gordon Foundation, established by Bernard and Sophia Gordon, to address the increasing need for young engineers who are prepared early in their careers to contribute to the development of products and technology. The program is housed in the Gordon Center for Subsurface Sensing and Imaging Systems, directed by Michael Silevitch, Robert D. Black Professor of Engineering.

The intensive one-year program culminates in a Graduate Certificate in Engineering Leadership (GCEL) and can lead to a Master of Science in Electrical and Computer Engineering Leadership (MSECEL) or another engineering discipline. The Gordon Fellows are typically sponsored by their employers. Coursework in engineering leadership and scientific foundations of engineering is complemented by a "challenge project," a market-worthy and technologically feasible effort of strategic importance to the student's sponsoring organization.

Today, Matt Dickman (GCEL and MSECEL, 2008) leads NeuroLogica Corporation's CereTom® product effort. His project involved the development of revolutionary cranial fixation devices that eliminate metal artifacts for accurate real-time portable computer tomography (CT) imaging in situations where it was previously unavailable, such as the operating room. This technology provides neurosurgeons with greater confidence that procedures will be successful before patients leave the operating table. Dickman now manages a team of three and travels globally to market and refine the CereTom® scanner. Michael King (GCEL, 2008) is an electrical design engineer at Raytheon Integrated Defense Systems. His project evaluated the effectiveness of using a set of highly distributed mobile sensors to deter radiological threats and contributed to Raytheon's receiving a substantial funding award from the Domestic Nuclear Detection Office for exploratory research. Karina Snow (GCEL, 2009) is a development engineer at GE Healthcare who is pursuing a master's in mechanical engineering. She leads a breast biopsy guidance program in collaboration with researchers at Massachusetts General Hospital.

Gordon Fellow Matt Dickman and surgeons at North Shore Long Island Jewish Medical Center view intraoperative CT images from the CereTom®

Among the fall 2009 Gordon Fellows is John Banzhaf, whose work is related to ALERT, a Department of Homeland Security–funded Center of Excellence at Northeastern. Banzhaf is sponsored by Pacific Northwest National Laboratory's (PNNL) National Security Directorate through the National Security Internship Program. He will take a leading role in a collaborative effort between PNNL and Northeastern that focuses on identifying viable detection techniques related to vehicle-borne improvised explosive devices.

ADVANCEs for Women in Science and Engineering

NSF Transformation Grant Supports Five-Year Program

ADVANCE professional development workshop

Breaking down institutional barriers; advancing women in academic fields; increasing the representation and advancement of women in academic science, technology, engineering, and mathematics (STEM) careers; and "contributing to the development of a more diverse science and engineering workforce" are the goals to be pursued with the $3.7 million Northeastern University received from a National Science Foundation (NSF) ADVANCE grant announced in April 2009. Through NSF's ADVANCE Institutional Transformation Award for Advancing Women in Interdisciplinary and International Networks, Northeastern is launching a five-year program to increase recruitment and other opportunities for women on campus.

Northeastern, one of nine new sites awarded the institutional transformation grants in 2008, resolves to be innovative in its approach, to avoid replicating similar efforts, and to be a university that other institutions of higher learning can emulate. "We want to go beyond what others have done," President Joseph E. Aoun said.

The ADVANCE award makes possible improved recruitment for applicant-pool diversity, interdisciplinary networking for prospective faculty, and funding opportunities for departments and programs to strengthen networks for collaboration. The award will also serve as a catalyst for prioritizing gender balance and diversity within the University's Academic Plan.

Directing the ADVANCE program at Northeastern is Sara Wadia-Fascetti, associate professor of civil and environmental engineering and special assistant to the provost for faculty development. Wadia-Fascetti works with a team of faculty colleagues who have administrative experience and represent an interdisciplinary mix of research areas. "Through strong commitment from the provost and participating deans, the ADVANCE team is collectively responsible for engaging the entire university in efforts that will increase and retain faculty women in engineering and science fields," said Wadia-Fascetti.

The ADVANCE award will support the University's goal of increasing the representation and progress of women in academic science and engineering careers by promoting positive changes that will advance all members of the faculty in research environments that are increasingly interdisciplinary and global. "This grant is an important part of Northeastern University's transformation into an institution that more strongly encourages growth and success for women in academia," said Provost Stephen W. Director.

New Master of Science in Energy Systems

Blends Engineering Skills with Knowledge of Financial Planning

To meet the growing demand for leaders with expertise in both energy technology and economics, the College of Engineering is offering a new Master of Science in Energy Systems (MSES). The MSES integrates technology aspects of energy systems development with training in economic and financial planning. The high-level, interdisciplinary program is intended for the engineer or technical professional interested in moving into leadership roles.

The goals of the program are to educate students in current and future energy systems technologies and to provide a background for integrating a broad spectrum of energy-related technologies along with the necessary economic and financial background to successfully implement the technologies. The program will also seek to develop leadership and decision-making skills for the application of energy systems in either the private or public sector of the global market.

The MSES curriculum is based in energy technology and includes significant interface with business and financial decision processes. The curriculum offers students flexibility in their course of study, with a set of six core courses in engineering knowledge and finance, plus four electives that can be taken from any department within the College of Engineering. Students will have access to both business educators and practicing professionals, and the opportunity to participate in a six-month co-op experience at an industry partner.

"The development of energy solutions within companies and for society involves knowing energy technologies and working within the business environment and financial constraints to implement them," said Gregory Kowalski, associate professor of mechanical and industrial engineering and director of the MSES program. "This program provides students with a foundation in alternative energy and leading-edge combustion technologies, integrating them with trigeneration and conservation practices that include the related economic and political aspects."

Mobility Assistance through Robotics

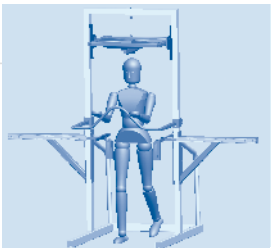
Breakthrough robotics technology from Northeastern has again received funding from the National Science Foundation. Two inventions by Constantinos Mavroidis and his team will receive support of more than $1 million over the next three years.

In partnership with Harvard Medical School (HMS)–affiliated Spaulding Rehabilitation Hospital's Motion Analysis Laboratory, Northeastern's Biomedical Mechatronics Laboratory will develop the Robotic Gait Rehabilitation (RGR) Trainer and the Active Knee Rehabilitation Orthotic Device (AKROD) for rehabilitation of the pelvis and the knee, respectively. The devices could benefit patients with neurological ailments, including stroke survivors and those recovering from wounds and accidents.

While the RGR Trainer will provide a study of patient-robot interaction via haptic and visual feedback provided through the pelvis, AKROD will build upon the technology of a knee rehabilitation device with resistive force developed by Mavroidis and his team; they will develop and test a device with an active component for gait rehabilitation for people with knee problems.

"Robotics and mechatronics offer the promise of sensitive, objective measurements and mobility assistance by using wearable, portable, computer-controlled active devices," said Mavroidis, professor of mechanical and industrial engineering. The RGR Training device will generate force fields applied at the pelvic area to facilitate treadmill gait retraining in patients with abnormal gait patterns.

Data from both normal volunteers and hemiplegic stroke survivors will help to create training programs for knee orthosis to assist patients in reestablishing a natural gait pattern. With resistive (variable damper) and active (torque actuator) components,



Robotic gait rehabilitation trainer using force feedback at the pelvis

AKROD is meant to train patients in correct knee hyperextension during stance and reduced knee flexion during swing.

The projects include activities for undergraduates to conduct research in robotics, industry internships, projects to attract high school students to the field, and seminars and websites on robotic rehabilitation devices.

The AKROD project also includes a collaboration between Northeastern and WGI, Inc., a supplier of precision parts and assemblies for aerospace, industrial, and medical applications. The University and the company signed an R&D licensing agreement for Electro-Rheological Fluid (ERF, otherwise known as "smart fluid") technology, a foundation for a series of devices invented by Mavroidis and his team.

Monitoring Heart Disease with a Single Drop of Blood

A team of researchers led by Shashi Murthy, assistant professor of chemical engineering, has developed a device that can monitor cardiovascular health by using just 200 microliters of blood. Smaller than a slim cell phone, the device makes use of antibodies that naturally bind to endothelial progenitor cells present in a blood sample. The number of these cells in an individual's blood is a direct measure of cardiovascular health. Endothelial progenitor cells have the ability to repair damaged vessels. Studies have shown that their numbers are decreased by typical cardiovascular risk factors, such as high cholesterol.

Murthy, the project's lead researcher, recently published a paper on his novel method of disease detection in the *Federation of American Societies for Experimental Biology Journal*. The coauthors of this study are Brian Plouffe, a chemical engineering doctoral student at Northeastern; Tatiana Kniazeva, a chemical engineering undergraduate at Northeastern; and Virna Sales, a Harvard Medical School instructor and a cardiovascular surgeon at Children's Hospital Boston.

It will take at least two years, Murthy said, before the diagnostic tool is available for clinical use. Over the next several months, he and his team will begin to test the reliability of the device by studying blood samples from patients known to be at risk or known not to be at risk for heart disease. Murthy is also working to obtain funding from government and private sources for this extensive clinical study.

Eventually, Murthy hopes to move beyond using the device solely as a diagnostic application. Endothelial progenitor cells have been shown to repair damaged blood vessels in animals; it may be possible to repair damaged arteries by isolating these cells from the circulating blood of a patient, multiplying them, and injecting them into damaged tissue in the patient's body via a surgical procedure.

This technology is part of a broad family of microfluidic devices being designed by Murthy's lab for a wide variety of applications, from isolating stem cells from adult tissue samples (such as cardiac, skin, and intestinal tissue) to diagnosing diseases. The versatility of these devices, said Murthy, arises from the extreme simplicity of their design, which will facilitate their ultimate use in clinical settings.

Noninvasive Brain Computer Interfaces with Electroencephalography

The last decade has brought great improvements in the design of systems that will enable direct communication between the human brain and artificial systems. Brain signal acquisition modalities range from invasive microelectrode and electrocorticography (ECoG) to noninvasive electroencephalography (EEG) and near-infrared spectrum (NIRS) optical techniques. Brain computer interface (BCI) will revolutionize human/computer interaction; it offers promise to people with motor, speech, and communication disabilities to express themselves, and emerges as a potentially transformative human/computer interaction modality for various attention- and information-intensive tasks. Researchers in COE are developing noninvasive BCI technologies under major funding from DARPA, NIH, NSF, and the Nancy Lurie Marks Family Foundation.

Deniz Erdogmus, assistant professor of electrical and computer engineering, is collaborating with Honeywell Human Centered Systems Research Laboratory to develop, under DARPA funding, a BCI-based image-retrieval system from massive image databases. This technology is aimed at exploiting the acute visual target detection and recognition capability of the human operator.

Erdogmus is also working with Oregon Health and Science University to develop a noninvasive smart BCI-based typewriter for people with locked-in syndrome (LIS), as part of a five-year NIH-funded project. The BCI typewriter will feature adaptive EEG signal processing and user-specific open-vocabulary language models to achieve high communication throughput via fusion of information from the EEG signals and the language model.

Erdogmus, along with Rupal Patel, associate professor in the Speech-Language Pathology and Audiology Department, recently started a three-year NSF-funded project to design an icon-based text-generation system operated via a BCI. The expectation is that in closed-vocabulary conversational environments, an iconic representation of words and phrases will lead to a more natural and faster visual stimulus selection paradigm in the context of BCI-based human/computer interaction.

These projects rely on a BCI technique that exploits the visual P300 response of the brain, which is a strong positive increase in scalp voltage that occurs after 300ms in response to an interesting or target stimulus. “The main technical challenge here is the accurate and precise detection of P300 responses in each single trial from multichannel EEG measurements in real time,” said Erdogmus. “The successful solution of this single-trial event-related potential detection problem is key to the future widespread and practical usability of BCI systems, and it is one of the main problems our group focuses on.”

Seeing Disease with Laser Light

Mark Niedre, assistant professor of electrical and computer engineering, along with his collaborators from COE and Harvard Medical School (HMS), is developing new methods of disease imaging in live animals with laser light. The research has many implications for understanding how diseases such as cancer develop and can be treated with new therapies. The underlying technology utilizes fluorescent probes that are targeted to specific molecules in the body that can then be detected with advanced optical-imaging devices.

Niedre, who joined COE in fall 2008 from HMS, has begun working on the development of an instrument to noninvasively detect very rare circulating cells in the bloodstream, first in live animals and, eventually, if all goes well, in humans. In June 2009, Niedre was awarded a $380,000 New Investigator grant from the Massachusetts Life Sciences Center to develop the concept. The device will use rapid optical sampling of the blood vessels and search for characteristic signals from circulating cells. “In principle, we will be able to sample the entire blood volume in minutes,” said Niedre.

It is anticipated that the instrument will be used to better understand the processes behind the metastatic spread of cancer, as well as the mechanisms by which hematopoietic stem cells mobilize in the bloodstream. The research is being conducted in collaboration with Shashi Murthy, assistant professor of chemical engineering, and HMS researchers.

Niedre’s related research in ultrafast small-animal fluorescence imaging, performed with Professor Vasilis Ntziachristos of the Technical University of Munich, was published in the *Proceedings of the National Academy of Sciences* and featured in the *MIT Technology Review.* “The problem with imaging with laser light in biological tissue is that it undergoes a tremendous amount of scatter,” said Niedre. The solution involved the use of high-speed pulsed lasers and ultrafast detectors to preferentially select light that had traveled along a more direct path. The researchers were able to use the technique to accurately image lung cancer in mice. “Practically, it’s very tricky to do, because these things are happening on a very fast, picosecond time scale,” added Niedre.

“Right now, we can image one fluorescent target at a time. We would like to be able to push that so that we could image even more targets simultaneously in an efficient way,” said Niedre. This would allow scientists to perform research that is currently very difficult, such as studying molecular responses to new anti-cancer therapies. “Putting the information from multiple molecular targets together can help researchers better optimize current therapies and better understand which new ones may prove successful,” said Niedre.

Acknowledging Faculty Accomplishments in Research and Teaching

2009

PROMOTION

In recognition of her path-breaking career and cutting-edge research, the Northeastern University Board of Trustees has promoted Jacqueline Isaacs to Professor of Mechanical and Industrial Engineering. An associate director of the Northeastern Center for High-rate Nanomanufacturing (CHN), she leads the center's research effort on societal implications of nanotechnology.

The recipient of a 1988 National Science Foundation Faculty Early Career Development (CAREER) award, Isaacs has focused her research on environmental and economic issues in advanced materials processing. At CHN, she reviews the life-cycle assessment of processes under development and evaluates various alternatives to find environmentally benign processes or products. This research has evolved into the field known as "environmentally benign design and manufacturing."

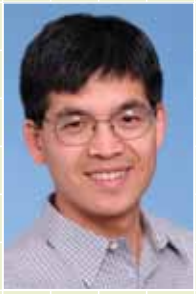
As a researcher at the Massachusetts Institute of Technology (MIT), and now as a faculty member at Northeastern, she has worked to develop spreadsheet-based modeling tools to help assess the environmental attributes and economics of various manufacturing and recycling processes, both existing and under development.

Isaacs has organized sessions for national professional society meetings, including the American Society for Engineering Education, the IEEE International Symposium on Electronics and the Environment, and the Materials Research Society. In 2000, she received a Northeastern University Excellence in Teaching Award. She received a PhD in materials science and engineering from MIT in 1991.

TENURE

Mehrdad Sasani, Associate Professor of Civil and Environmental Engineering, conducts research in structural engineering, including progressive collapse of structures, earthquake engineering, and structural reliability. His work is supported by the National Science Foundation, the U.S. General Services Administration, and the Department of Homeland Security. Sasani's expertise in the progressive collapse of structures has been featured on the Discovery Channel, and he has pioneered a research program on collapse resistance of actual full-scale structures. He organized the First National Educational Competition on Predicting Progressive Collapse Resistance of RC Structural Systems at Northeastern and is planning the second competition. Sasani was the recipient of a 2006 National Science Foundation Faculty Early Career Development (CAREER) award. He has been a member of committees of the American Concrete Institute on performance-based design of concrete structures, seismic repair and rehabilitation, and seismic shear. He is also a member of the ASCE/SEI task committee on progressive collapse. Sasani received a PhD in structural engineering from the University of California, Berkeley, in 2001.

Milica Stojanovic, Associate Professor of Electrical and Computer Engineering, conducts research in digital communications, signal processing, detection and estimation theory, and communication networks. She is interested in communication system design and performance analysis for time-varying channels, with related applications to mobile wireless environments in general and underwater acoustic communication channels in particular. She is also a visiting scientist at MIT and a guest investigator at the Woods Hole Oceanographic Institution. An active member of the IEEE and the Acoustical Society of America, Stojanovic is an associate editor of the IEEE *Journal of Oceanic Engineering* and the Elsevier *Journal of Physical Communication*. She is a member of the IEEE Ocean Engineering Society's Administrative Committee. Stojanovic received her MS and PhD in electrical engineering from Northeastern University.



Nian-xiang Sun, Associate Professor of Electrical and Computer Engineering, was a scientist at IBM and Hitachi Global Storage Technologies before joining the Northeastern faculty. He won a first prize IDEMA Foundation Fellowship in 2000, the ONR (Office of Naval Research) Young Investigator Award in 2007, and a 2008 National Science Foundation (NSF) Faculty Early Career Development (CAREER) award. His research interests include novel magnetic, ferroelectric, and magnetoelectric materials and devices; magnetic sensors; material and device properties at RF/microwave frequencies; energy-harvesting materials and devices; and micro/nanotechnologies for biomedical magnetic sensing. Sun has published more than 70 technical papers and filed more than 20 U.S. patents and patent disclosures. His research is supported by the NSF and ONR, among others. Sun received his PhD from Stanford University in 2002.

Mehdi B. Tahoori, Associate Professor of Electrical and Computer Engineering, focuses his research on test, reliability, and design automation of digital systems. In particular, his current research directions are in nanocomputing, dependable computing, and system biology, specifically analysis of complex molecular pathways in human disorders. He was a 2008 recipient of the National Science Foundation Faculty Early Career Development (CAREER) award. His professional activities include serving as program chair of the IEEE Defect-Based Testing Workshop; program committee member of the IEEE International Workshop on Design and Test of Defect-Tolerant Nanoscale Architectures; and program committee member of both the IEEE International Test Synthesis Workshop and North Atlantic Test Workshop from 2005 to 2008. He was guest editor of the *IEEE Design and Test* special issue on Advanced Technologies and Reliable Design for Nanotechnology Systems in 2005. Tahoori received a PhD from the Department of Electrical Engineering at Stanford in 2003.

College of Engineering

Welcomes New Faculty

› **Dagmar Sternad,** Professor, is a member of Northeastern's interdisciplinary faculty. She holds joint appointments as professor of electrical and computer engineering in the College of Engineering, professor of biology in the College of Arts and Sciences, and a courtesy appointment in physics. As director of the Action Laboratory, she researches motor control and neuroscience with a focus on learning and control of movement coordination in humans, in both healthy and neurologically impaired individuals. In recent research, she extended experimental paradigms to address the question of how learning can be facilitated, with a special focus on rehabilitation. From 1995 to 2008, she was assistant, associate, and full professor at the Pennsylvania State University in kinesiology and integrative biosciences. Her work is documented in more than 80 publications in scientific journals and books, including *Progress in Motor Control: A Multidisciplinary Perspective.* She is also executive editor of the *Journal of Motor Behavior* and a member of the National Institutes of Health (NIH) Taskforce on Childhood Motor Disorders and has served on panels of the National Science Foundation and NIH. She received a PhD in experimental psychology from the University of Connecticut.

› **Nader Jalili,** Associate Professor, Department of Mechanical and Industrial Engineering, comes to Northeastern from Clemson University, where he was associate professor of mechanical engineering and the founding director of the Smart Structures and NEMS Laboratory. He received a PhD from the University of Connecticut in 1998. His research interests and expertise include piezoelectric-based actuators and sensors; vibration control of distributed-parameters systems; dynamics and control of microelectromechanical and nanoelectromechanical sensors and actuators; and control and manipulation at the nanoscale. He is the associate editor of the American Society of Mechanical Engineers *Journal of Dynamic Systems, Measurement and Control;* founding chair of the ASME Technical Committee on Vibration and Control of Smart Structures; and past technical editor of IEEE/ASME *Transactions on Mechatronics*. He is the author or coauthor of more than 270 technical publications, including over 75 journal papers. His honors include the 2003 CAREER Award from the National Science Foundation and the 2002 Ralph E. Powe Junior Faculty Enhancement Award from the U.S. Department of Energy.

› **Moneesh Upmanyu,** Associate Professor, Department of Mechanical and Industrial Engineering, was previously associate professor at the Colorado School of Mines. His research is aimed at multiscale mechanics and physics in several classes of material systems. He heads the Group for Simulation and Theory of Atomic-Scale Material Phenomena (stAMP), with research interests that include interfacial phenomena during annealing of polycrystalline microstructure; structure-mechanics-morphology-property relations in low-dimensional systems such as thin films and nanowires; and atomistics, mechanics, and self-assembly of semiflexible and elastically stiff filamentous aggregates as well as their networks in biology and technology. His group's principal expertise is in computational techniques such as molecular dynamics and Monte Carlo–based methods and their links with coarse-grained theoretical and computational frameworks, with close to 30 peer-reviewed publications. He is a member of the Materials Research Society, the Minerals, Metals and Materials Society, the American Physical Society, the American Society for Metals, and the Society for Industrial and Applied Mathematics. He earned a bachelor's degree and a master's degree at the Indian Institute of Technology and a PhD at the University of Michigan.

› **Kaushik R. Chowdhury,** Assistant Professor, Department of Electrical and Computer Engineering, graduated with a BE in electronics engineering with distinction from VJTI, Mumbai University, in India, in 2003. In 2006 he received an MS in computer sciences from the University of Cincinnati, where his thesis was given the outstanding award by both the electrical and computer engineering and computer science departments. He earned a PhD from the Georgia Institute of Technology in 2009. He won the broadband wireless networking researcher of the year award in 2007 and the best paper award at the Ad Hoc and Sensor Networks symposium at IEEE ICC 2009. His expertise and research interests lie in wireless cognitive radio ad hoc networks, resource allocation in wireless multimedia sensor networks, and biomedical applications of sensors. He is a member of the IEEE Communications Society and the Association for Computing Machinery.

› **Ningfang Mi,** Assistant Professor, Department of Electrical and Computer Engineering, earned a PhD from the Department of Computer Science at the College of William and Mary in 2009, with a doctoral dissertation on dependence-driven techniques in system design. She received a BS in computer science from Nanjing University, in China, in 2000 and an MS in computer science from the University of Texas at Dallas in 2004. Her research interests include storage systems, multitier systems, performance evaluation,

energy/power management, web characterization, data analysis, system modeling, and scheduling/load balancing.

› **Gunar Schirner,** Assistant Professor,

Department of Electrical and Computer Engineering, earned an MS in 2005 and a PhD in 2008 in electrical and computer engineering from the University of California, Irvine. Prior to joining the Northeastern faculty, he was an assistant project scientist at the Center for Embedded Computer Systems at the University of California, Irvine. He also had five years of industry experience at Alcatel (now Alcatel-Lucent), where he designed distributed embedded real-time software for telecommunication products. His research interests include embedded system modeling, system-level design, and the synthesis of embedded software.

› **Reza Sheikhi,** Assistant Professor,

Department of Mechanical and Industrial Engineering, was a research scientist in the Department of Mechanical Engineering at Virginia Tech, and prior to that he was a research associate in the Department of Mechanical Engineering and Materials Science at the University of Pittsburgh, where he received a PhD in 2005. His current research is focused on computational simulation and mathematical modeling of energy, combustion, and propulsion systems. He is also involved in large-scale scientific computing and algorithm development. He is a member of the American Physical Society and the American Society of Mechanical Engineers, and a senior member of the American Institute of Aeronautics and Astronautics.

Another NSF CAREER Award

for College of Engineering Faculty

Luca Caracoglia, Assistant Professor of Civil and Environmental Engineering, is the most recent College of Engineering faculty member to be named a recipient of the Faculty Early Career Development (CAREER) award from the National Science Foundation. This brings the total to 18 faculty members to be so honored. CAREER grants to junior faculty recognize "outstanding research, excellent education, and the integration of education and research." Caracoglia will conduct research on developing a methodology to analyze wind loading and structural response uncertainty in tall buildings affected by wind hazards.

Professor Luca Caracoglia

Among the issues Caracoglia will address in his research are damage to building façades or other nonstructural elements, and discomfort levels and immediate occupancy issues for residents. The study will make use of performance-based simulation and analysis techniques.

Faculty Awards and Honors

Teiichi Ando, Professor of Mechanical and Industrial Engineering, has been elected a Fellow of ASM International.

Dana H. Brooks, Professor of Electrical and Computer Engineering, and **Charles A. Dimarzio,** Associate Professor of Electrical and Computer Engineering, won the Microscopy and Microanalysis 2008 Best Techniques Paper award for their paper titled "Determination of the Number of Cells in Preimplantation Embryos by Using Non-invasive Optical Quadrature Microscopy in Conjunction with Differential Interference Contrast Microscopy," coauthored by J. A. Newmark, W. C. Warger II, C. Chang, G. E. Herrera, and C. M. Warner.

Mehmet Dokmeci, Assistant Professor of Electrical and Computer Engineering, was presented with the Best Poster Award at the 8th IEEE Conference on Nanotechnology, an honor that acknowledges promising research in experimental work involving carbon nanotubes.

Andrew Gouldstone, Assistant Professor of Mechanical and Industrial Engineering, was the recipient of the *Journal of Thermal Spray Technology* Best Paper Award at the International Thermal Spray Conference for "On the Role of Bubbles in Metallic Splat Nanopores and Adhesion," coauthored with Meng Qu.

Gregory Kowalski, Associate Professor of Mechanical and Industrial Engineering, received a 2008 Dedicated Service Award from the American Society of Mechanical Engineers.

Fabrizio Lombardi, ITC Endowed Professor of Electrical and Computer Engineering, has been elected a Fellow of the IEEE for his contributions to testing and fault tolerance of digital systems.

Edwin Marengo, Assistant Professor of Electrical and Computer Engineering, was named the 2008 most distinguished alumnus of the Technological University of Panama in the category of research, innovation, and technological development.

Hameed Metghalchi, Professor and Chair of Mechanical and Industrial Engineering, has been named a member of the American Society of Mechanical Engineers Executive Committee.

Carmine Vittoria, Distinguished Professor of Electrical and Computer Engineering, has been elected a Life Fellow of the IEEE for his contributions to the understanding of the microwave properties of magnetic materials and their applications in microwave technology.

Yaman Yener, Associate Dean and Director of the Graduate School, has been elected a Fellow of the American Society for Engineering Education.

Students Provide Award-Winning Service

Making the World a Little Better

The Northeastern chapter of Engineers Without Borders (EWB) has been chosen by the U.S. State Department to be featured on the website www.America.gov in the fall. The EWB student chapter was chosen as an "example of the kinds of activities Americans do in the realm of volunteerism and international development." The State Department will be documenting a planned trip to Honduras in August, which will include EWB members Ryan Mahoney (Civ'10), Ann Polaneczky (Civ'11), Christian Mantilla (ChE'13), Dan Sullivan (Civ'12), Erin Stokes (ChE'10), and Dan Saulnier (Civ'98). The group's work in helping to bring a clean, reliable source of water to villagers in the Yoro district of Honduras was named "Project of the Month" in October 2008. Over the past four years, EWB has completed three separate water projects in Honduras, and future plans include continued efforts there and in Uganda. Member Ethan LaRochelle, a 2009 graduate of electrical engineering, was recently selected to receive 1 of 10 IEEE GOLD Humanitarian Fellowships for the project, "To Acquire Knowledge on Energy Application and to Develop a Water Pumping System," for which he was the project leader. He plans to use the funds for future EWB water-system projects.

A group of mechanical and industrial engineering capstone students who partnered with Greece-based Green Project have designed a groundbreaking robotic cleaning system for solar panels that has been submitted for a patent. The technology was developed by Jeremy Hastie, Andrew Sweezey, Ashton Grandy, and Mark Anderson, all 2009 mechanical engineering students.

EWB team next to a completed pipeline designed to carry 22,000 gallons of water/day to the village of El Chaguite, Honduras

Helping Out in the Community

The American Institute of Chemical Engineers (AIChE) group at Northeastern has been reaching out to young students in grades K–12 to help them connect with science and engineering programs in their communities.

The Northeastern Chapter of the American Society of Civil Engineers (ASCE) partnered with the Charles River Conservancy to repair the eroded slope on the Boston side of the Eliot Street Bridge by building a new staircase and landscaping the area to prevent further erosion.

Scholarship and Award Winners

The Mechanical Contractors Association of America's (MCAA) student group won first place in the national 2008–2009 student chapter competition.

Chad Boutet, Civ'10, won the PB Rail Engineering Scholarship from the American Railway Engineering and Maintenance-of-Way Association (AREMA).

Zhuhua Cai, ChE PhD student, received the Leo M. Falicov Student Award from the Magnetic Interfaces and Nano-structures Division of AVS for her presentation on MBE Integration of BaM on Wide Bandgap 6H-SiC.

Abby Deleault, ChE'09, won a Northeastern Outstanding Co-op Award for 2009.

Sean Mayo, EE'09, was awarded the William Jefferson Alcott Award for his outstanding co-op performances and contributions to society.

Roni Mittelman, an EE PhD student, and **Dilber Gamsiz** and **John Oldham,** both ChE PhD students, received Dissertation Writing Fellowships, which are sponsored by the Office of the Provost and offer financial support to PhD candidates so they may spend their final semester writing.

Necmiye Ozay, an EE graduate student, is the recipient of the best student paper award at the Conference on Decision and Control (CDC) for her paper titled "A Sparsification Approach to Set Membership Identification of a Class of Affine Hybrid Systems," coauthored with M. Sznaier, C. Lagoa, and O. Camps.

Christopher W. Stivers, ME'09, was awarded a Tau Beta Pi graduate fellowship.

Kelly Trowbridge, ChE'09, won the 2008 AIChE Donald F. and Mildred Topp Othmer National Scholarship.

Kimberly Wall, ChE'09, won the 2009 AIChE Northeast Region Paper competition. She will go on to represent the Northeast Region at the national competition in November.

The Student Affairs Office awards scholarships to recognize the contributions of our student leaders on campus. College of Engineering students were named recipients of the following: *Thomas I. Atkins Social Justice Scholarship*: Gidley Dorlus, ME'13, and Babatunde Ogunfemi, EE'13; *Karen T. Rigg Shining Torch Scholarship*: Joyce Salomon, EE'12; *Joseph Spear Scholarship*: Thomas Peacock, ME'10; and *Greg Jarvis Memorial Scholarship*: Stephen Asay, IE'09.

A CENTURY OF INNOVATION

COLLEGE OF ENGINEERING

100

CENTENNIAL

1909–2009

1909
Day courses begin at "The Co-operative Engineering School" with eight students and four co-op employers

1920
Bachelor's degrees are offered in civil, electrical, mechanical, and chemical engineering

1939
College of Engineering programs accredited by ECPD

1943
First women enroll at Northeastern, including one engineering student

1958
Graduate School of Engineering established

1960
Doctoral program added, research expanded

1984
George A. & Lorraine C. Snell Engineering Center opens

1996
The Richard J. (E '61, H '96) & Maureen Egan Research Center opens

1997
NASA-sponsored CAMMP research center established

2000
NSF ERC grant funds Center for Subsurface Sensing and Imaging Systems (CenSSIS)

2004
NSF NSEC grant funds Center for High-rate Nanomanufacturing

2005
George J. Kostas, E '43, names Nanoscale Technology and Manufacturing Research Center

2006
$20 million donation from Bernard M. Gordon names CenSSIS Research Center

2007
Edward (E '73) & Catherine Galante establish the Galante Engineering BS/MBA Program

2008
Homeland Security Center for Excellence grant funds ALERT Center

2008
NSF recognizes a record five engineering professors with prestigious CAREER Awards

2008
Sy Sternberg, ME '68, chairman of New York Life Insurance Co., named chairman of the Board of Trustees

2009
September 2009 Centennial Freshman Class arrives on campus

If you have questions, or to make your gift to engineering, contact Mark O'Donnell, Director of Development, College of Engineering, at 617.373.4845 or via e-mail at m.odonnell@neu.edu.

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An NSF NSEC

The Center for High-rate Nanomanufacturing receives **$12.25 million** from the National Science Foundation

Center for High-Rate Nanomanufacturing

The National Science Foundation announced that the Nanoscale Science and Engineering Center for High-rate Nanomanufacturing, a joint partnership among Northeastern University, the University of Massachusetts Lowell, and the University of New Hampshire, has received a renewal grant of $12.25 million that will extend the center's funding for an additional five years.

The center uses high-rate/high-volume template-guided directed assembly of nanoscale building blocks (nanotubes, nanowires, proteins, etc.) as the platform to produce very small devices with superior properties and features compared to current electronics, energy, medical, and materials products. The center is also investigating the environmental, economic, regulatory, social, and ethical impacts of nanomanufacturing. The center is working with 36 industrial partners to develop tools and processes that could accelerate the creation of highly anticipated commercial products.

Director: Ahmed Busnaina, William Lincoln Smith Professor of Mechanical Engineering, Northeastern University