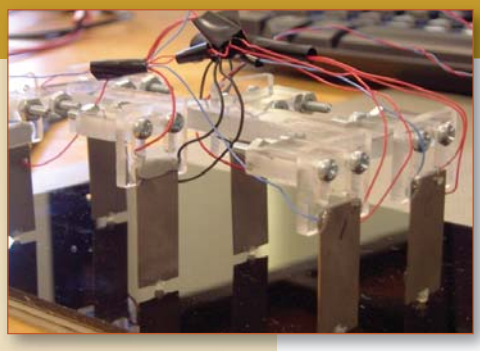
Mechanical Engineering

Autumn 2008

The MEssenger

UNIVERSITY OF WASHINGTON
COLLEGE of ENGINEERING
A Community of Innovators

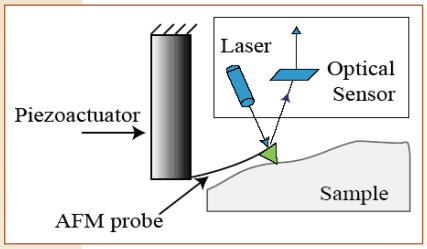


Piezo-robot with six legs. Each leg is a piezoactuator.

Atomic Force Microscopy: Mechatronics at Work

Just like a physician pressing on the stomach area to diagnose the reasons for abdominal pain, an atomic force microscope (AFM) presses the surface of a cell with a probe to investigate reasons for abnormal behavior such as reduced cell locomotion due to aging effects. The AFM probe can do such investigations with pico (10^{-12}) Newton force resolution at the nano (10^{-9} meter) scale. This ability has made AFMs key enabling tools in the experimental investigation and manipulation of nanoscale biological, chemical, material, and physical processes. Therefore, research in the ME department aimed at increasing the operating speed of AFMs during nano-imaging and nanofabrication will impact a wide range of emerging nanosciences and nanotechnologies.

Research on AFM builds on core ME competency in areas such as sensors and actuators, dynamics, vibrations, and controls. For example, piezo-actuators are used for nanoscale postioning of the AFM probe over the sample surface. These actuators convert electrical inputs (such as voltages) into mechanical motion with nanoscale precision. During high-speed movement of the AFM probe over the sample surface, mechanical vibrations in the system can lead to loss of precision in positioning. This can result in large forces between the AFM probe and the sample and potentially damage the sample or probe. To avoid this, the probe deflection is measured (using optical sensors and signal conditioning) and excessive forces are prevented using computer-



Continued on page 3.

DOE Grant Funds Tidal Energy Research

The US Department of Energy, on September 18, 2008, announced the award of a National Marine Energy Research Center at the University of Washington and Oregon State University. OSU will serve as the lead institution and focus on coastal wave energy, while the UW will focus on tidal energy in estuaries and free-flow turbine applications. UW co-directors are Professors Phil Malte (Mechanical Engineering) and Mitsuhiro Kawase (Oceanography). Funding involves five years of USDOE support. The total five-year package is $13.5 million, with $2.7 million at the UW.

According to Phil Malte, "the Center will permit the UW to expand its studies on the potential of tidal and hydrokinetic energy, including continued partnering with the Snohomish Public Utility District, which also received funding under the USDOE program, and the Electric Power Research Institute. Hydrokinetic energy involves the operation of turbines in free-flowing streams of water without the building of dams. Partnering with other firms will also be possible, including Seattle-based BioSonics in the area of marine instrumentation and monitoring,

Continued on page 2.

Verdant Power installing free-flow turbine into the East River, in New York.

In this issue

Chair's Corner

ME Chair

Mark Tuttle

This is an exciting time of the year—as I write this column the 2008–09 academic year is about to begin! This fall we have admitted 113 undergraduate and 41 graduate students into our program, bringing our total combined enrollment to 396 students, an increase of about 13. My colleagues and I look forward to helping these talented young men and women achieve their educational goals in the months ahead.

I would like to personally welcome our newest faculty member, Prof. Amy Shen. We were fortunate to recruit Amy from Washington University in St. Louis. She brings extensive teaching and research expertise to the department, particularly in the areas of microfluidics and the synthesis of nano-materials and structures. Please see pg 7 for a more detailed introduction to Prof. Shen. We also recently recruited two additional faculty: Prof. Junlan Wang from the University of California-Riverside, who will arrive on campus in January 2009, and Prof. Eliot Fried from Washington University, who will arrive in September 2010. Detailed introductions to Professors Wang and Fried will appear in future issues of *The MEssenger*.

Recent issues of *The MEssenger* have highlighted our extensive and diverse research activities, grouped into four main categories:

- Health systems and biotechnologies (Spring '07)
- Advanced materials and manufacturing (Autumn '07)
- Environmentally sensitive energy conversion (Spring '08)
- Mechatronics

This issue offers an overview of our work in mechatronics, an integration of the traditional fields of mechanical, electrical, materials, and computer engineering. A fundamental objective in all applications of mechatronics is precise control and automation of engineered systems. The application of mechatronics in atomic force microscopes (see pg 1) is a perfect example. Mechatronics is vitally important in every industry that involves a physical product, including the automotive, aerospace, biomedical, and consumer products industries, for example. Pages 4–5 provide a brief summary of the contributions to mechatronics by our faculty and students. Please visit the websites indicated to explore these activities in greater detail.

In closing, I would like to reemphasize a message from earlier Chair's Corners: There has never been a better time to pursue a career in mechanical engineering. According to the annual survey published by the National Association of College and Employers (*Job Outlook 2008*), mechanical engineers are amongst the most sought-after graduates nationwide, trailing only those with degrees in accounting. The UW ME Department is composed of a truly exceptional group of faculty, staff, and students, and our future has never looked brighter!

Tidal Energy Research

Continued from page 1.

Verdant Power in the area of turbine installation (photo pg 1), and the Pacific Northwest Economic Region serving the northwest states and Canadian provinces."

Malte states that, the major thrusts of the UW Center will be:

- Environmental impact modeling is a cornerstone of the UW effort. The goal is to understand the potential impacts of undersea turbines and to understand how to site, deploy, and operate the turbines with negligible impact to the estuary and its life. Results will be shared with local, state, and federal agencies to inform policy decisions. Prof. Kawase will lead this effort.
- Mobile instrumentation packages for device and environmental monitoring will be developed. Packages will leverage the expertise of industry partners to address the needs of the stakeholders. Dr. Jim Thomson of the Applied Physics Lab will lead this effort.
- Device and array optimization will use both laboratory and computer models compared against observational data from pilot tests. Models will initially focus on individual devices and then scale up to fields of devices for investigation of both near and far-field effects. Prof. Alberto Aliseda of ME will lead this effort.
- To increase the reliability and survivability of marine energy systems, the use of corrosion and bio-fouling resistant materials and structural composites will be investigated. Prof. Mark Tuttle of ME will lead this effort.
- Hydrokinetic energy conversion in constructed water-ways may offer additional opportunity for in-stream power. Prof. Malte will lead this effort. ▪

Snohomish PUD tidal logo

College of Engineering Lecture Series

Beyond Oil: Powering the Future

Thursday, October 30, 2008
7 pm
Kane Hall 110

Miles P. Drake
Senior Vice President
Research and Development, Chief Technology Officer, Weyerhaeuser

Daniel Schwartz
College of Engineering
University of Washington

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Admission free. Seating limited.
Registration required.
To register go to uwalum.com
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Endoscopic view from inside a rolled-up map. The camera produces resolution greater than 500 lines per inch.

"Camera in a Pill" a Major Advance in Endoscopic Technology

Fiber endoscope is about the size of an ordinary pill.

What began as an idea discussed by Eric Seibel and Mike Kimmey, then modified by research scientists Rich Johnston and Dave Melville and other UW researchers, may soon become a commercial reality with the potential to save many lives through early detection of Barrett's esophagus (BE), an abnormal growth that may lead to esophageal cancer. The device, a scanning tethered capsule endoscope (TCE), promises to make dramatic changes in both the cost of endoscopes and the ease and convenience of the endoscopic procedure.

The incidence of esophageal cancer in the US is rising faster than for any other cancer, and has become the sixth leading cause of death from cancer in men. Existing endoscopy is sufficient for monitoring patients already diagnosed with Barrett's esophagus, but 95% of esophageal cancer develops in patients previously undiagnosed with BE. Endoscopies to detect BE are not often performed due to cost and inconvenience. A patient undergoing an endoscopy must be sedated prior to the procedure, resulting in lost time from work and the need for someone to transport and attend the patient. The cost for the procedure is $600. According to Seibel, the cost of a TCE procedure is expected to be about half that.

The TCE contains a resonant fiber-optic laser scanner at the distal tip, which fits into a 6.4-mm easy-to-swallow capsule. The soft spaghetti-like tether contains a single-mode optical fiber multiplexed to three laser diodes at the proximal end. As the probe is swallowed, the fiber scanner captures high-resolution, wide-field color images. Video images are recorded as the capsule is retracted by its tether, and associated software generates panoramic images from the video output. Because of its small size the TCE can be swallowed with minimal patient discomfort, obviating the need for sedation. The proof: Eric Seibel himself was the first volunteer to "swallow the pill" and undergo an endoscopy by TCE.

The TCE offers significant advantages over existing technology and methods, and the promise of a greatly reduced death rate from esophageal cancer through early detection. But, as Seibel says, "There is no impact on society without commercialization." The UW has granted an exclusive license for scanning fiber endoscope (SFE) technologies to Pentax Life Care Division of Hoya Corporation of Japan, which expects to develop and market this endoscope technology within a few years. Pentax is one of the world's leading companies in medical imaging. The licensing of SFE technology is one of the largest technology transfer agreements in UW history.

As the commercialization of the TCE proceeds, Seibel and the rest of the UW research team will continue to develop scanning fiber technologies for other uses. In addition to detection and treating cancer in other organs, such as the pancreas, lungs, and bladder, potential applications could include laser diagnostics and therapeutics, image-guided mining and core sampling, and the remote exploration of unsafe or unstable structures. ▪

Material adapted from Seibel, Eric, et al, "Tethered Capsule Endoscope, A Low-Cost and High-Performance Alternative Technology for the Screening of Esophageal Cancer and Barretts's Esophagus," *IEEE Transactions on Biomedical Engineering*, Vol. 55, No. 3, 2008.

Material adapted from *Ingenuity*, spring 2008, Vol. 5, No.1.

Atomic Force Microscopy

Continued from page 1.

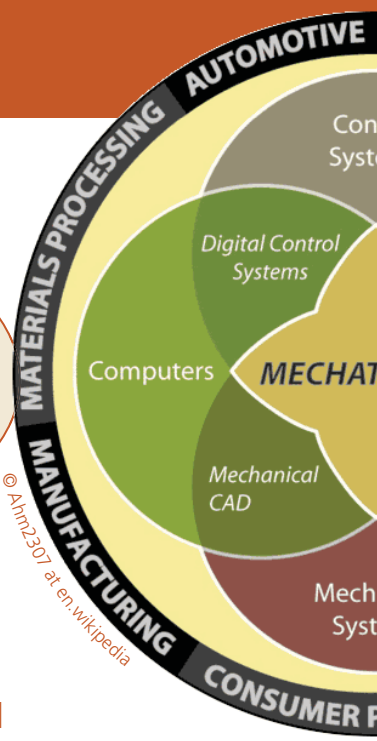
based controllers. Thus, the AFM is an excellent example of a mechatronics system in which mechanical, electrical, and computer technologies are integrated to optimize performance.

The AFM illustrates the need for mechanical engineers, with expertise in mechatronics, to handle the challenges of emerging technologies. Therefore, the ME department integrates research on nanopositioning systems into its mechanical engineering curriculum. (See website on mechatronic projects at http://faculty.washington.edu/devasia/Teaching/Example_projects.htm.) Undergraduate students learn about nanopositioning actuators (such as piezoactuators used in AFMs) by designing and controlling novel robots using these same actuators.

Undergraduate students Robert David Oylear and Amar Seta developed the robot shown on page 1. This insect-like robot has six legs; motion in each leg was generated using bimorph piezoelectric actuators, which were driven by asymmetric input waves. The finished robot successfully met design criteria of 6" x 6" x 6" maximum size. Although each actuator's motion was only in the micron range, the robot successfully achieved a speed of 1.8 cm/s. This project was part of spring 2007 ME 495 Capstone Design Project in mechatronics. ▪

Robert David Oylear (L), Amar Seta (R) holding their robot.

Mechatronics Research



Mechatronics is the term originally coined to describe the integration of mechanical, electrical, control, and computer technologies into the design of complex products. Although products have long included all four components, traditional design methods viewed them as separate, independently realized aspects of the design. Mechatronics emphasizes global optimization by integrating these four components of the design process.

Brian Fabien

Brian Fabien

In the Dynamic Systems and Controls Laboratory we are developing high efficiency motor/generators for flywheel energy storage (FES) devices. The motor/generator is used to spin the flywheel, and extract energy from the flywheel. An actuator is configured so that the magnetic flux of the motor is axial. This arrangement leads to a very efficient, high torque, compact motor/generator design. A goal of our research is to develop simple techniques for using the motor/generator to ensure stable operation of the FES device over all operating speeds, in the presences of external disturbances and imbalances of the flywheel.

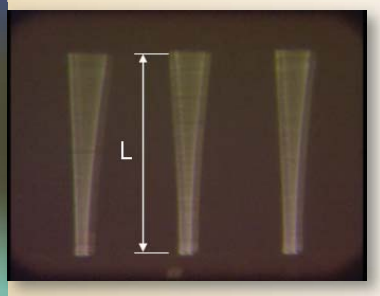
- http://abs-5 .me.washington.edu/

L to R: Chris Brown, Eric Seibel, W. Jong Yoon.

Eric Seibel

The Human Photonics Laboratory is an optomechatronics laboratory. The first major project is the scanning fiber endoscope that replaces a pixel array in an endoscope with a vibrating optical fiber. By using an amplitude-modulated resonance scan, this base-excited cantilever can deliver laser light from an endoscope that is three times smaller than current technology. Furthermore, unlike conventional scopes that use diffuse white light illumination, the directed laser light allows for integrated imaging with laser diagnostics and therapies. A second major project is a micro-optical version of a CT-3D imager for early cancer detection. Cells taken from the body are spun in a capillary tube while being imaged in transmission using standard cytological stains.

- www.me.washington.edu/people/faculty/seibel/

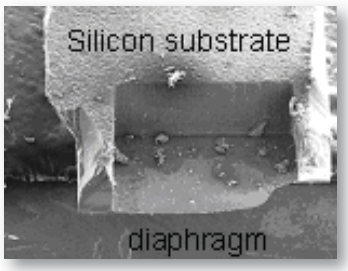


Resonating biomimetic silicone cilia made by graduate student Kieseok Oh (L = 400 μm)

Santosh Devasia

Prof. Devasia's research interests are in nonlinear systems, dynamics, and controls. Current theoretical and experimental efforts focus on developing nano-precision positioning systems for high-speed atomic force microscopes and scanning tunneling microscopes. These microscopes are key enabling tools in the investigation and manipulation of nano-scale phenomena such as cell migration. He is also developing control approaches to manage large distributed systems such as multiple aircraft in air traffic control. Prof. Devasia's collaborative research, with Prof. Jim Riley and Prof. Jae Chung, is developing biomimetic cilia-based micro and nano-fluidic systems.

- http://faculty.washington.edu/devasia/

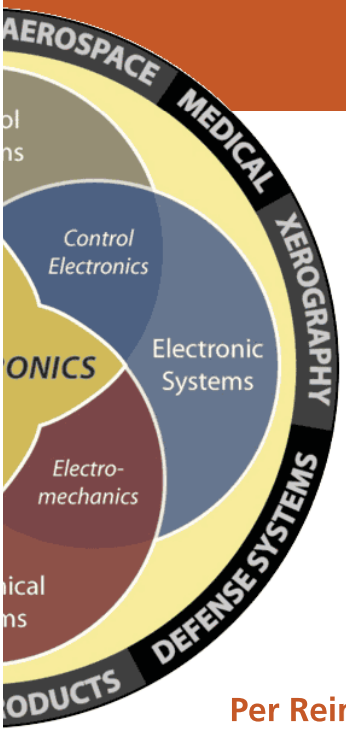


Acoustic actuator from a scanning electron microscope.

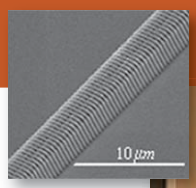
I-Yeu (Steve) Shen

Steve Shen is developing tiny acoustic actuators and microphones—smaller than a grain of rice—as hearing aids in human inner ears. These tiny acoustic actuators and microphones use piezoelectric thin-film materials to generate and sense pressure waves inside the cochlea (part of the inner ear). When the tiny acoustic actuators are combined with traditional cochlear implants, the integrated hearing aids will have better speech recognition capability than traditional devices, even in noisy environments. When the tiny micro phones are combined with traditional cochlear implants, the integrated hearing aids will provide more natural hearing and reduce surgical complexity and time.

- www.me.washington.edu/people/faculty/shen/



Wei-Chih Wang



Polymer-based waveguide

Wei-Chih Wang

Dr. Wang's research interests encompass integrated photonic devices, optical and electromagentic sensors, optoelectronic imaging devices, and acoustic MEMS devices for industrial and biomedical application. More recently, his research has been concentrated on development of soft polymer-based sensors and actuators. Since 2000, he has worked on various forms of active polymers, or so-called "smart materials," using polymer composites, electro-optic polymers, and conductive polymers to create new types of sensors and actuators for medical applications. By advancing sensor and transducer technology from current stiff semiconductors to polymer materials and developing new fabrication techniques, he aims to create a new class of biocompatible sensors with associated new diagnostics tools. The photo above shows a polymer-based waveguide with Bragg grating, produced using soft lithography and holographic interferometry.

- www.depts.washington.edu/mictech/home/

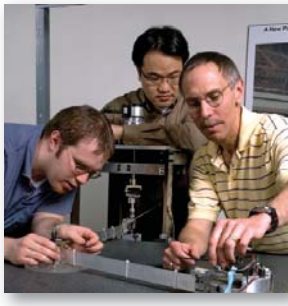
Per Reinhall

Per Reinhall (L) with Steve Shen (R)

Per Reinhall's research interests cover dynamics, acoustics, mechanics, and design. He is conducting research in the area of medical devices with emphasis on diabetes, prosthetics, heart disease, and early detection of cancer. He is also pursuing research in biocompatible sensors and actuators, vibration control of structures, fuel cell technology, nonlinear vibrations, and noise control.

- www.me.washington.edu/people/faculty/reinhall/

Martin Berg



L to R: Andrew Neeld, Taeyoung Jung, and Martin Berg.

Prof. Berg's research interests involve the modeling, analysis, and control of dynamic systems. His current projects focus on a non-linear control scheme for ultra-fine control of the position of the end-effector of an industrial robot or machine tool, during significant levels of mechanical friction. He has, in addition, recently developed a keen interest in the modeling, analysis, and supervisory control of discrete event systems. The logic that moves elevators in a high-rise office building, in response to user requests for service, is a classic example of such an application. His most recent proposal is a project that will apply his expertise in discrete event systems and GPS technology to assist law enforcement with of the enforcement of "no contact orders" between individuals.

- www.me.washington.edu/people/faculty/berg/

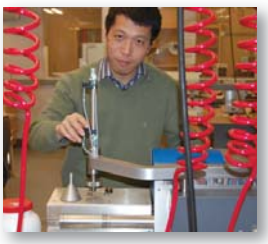
Joseph Garbini

Magnetic resonance force microscope

Prof. Garbini studies the analysis and control of dynamics. For the past 15 years he has worked to develop a special-purpose micro-electro-mechanical system: magnetic resonance force microscopy (MRFM). It combines elements of atomic force microscopy and magnetic resonance imaging to determine the location of resonant electron (or nuclear) spins from forces exerted on a micro-mechanical oscillator. The goal of the MRFM research team is to achieve one of the oldest dreams of the scientific community—to directly observe molecular structure nondestructively in three-dimensions, in situ, with angstrom-scale resolution. Such an imaging technology would address urgent needs in nanoscale engineering, materials science, molecular biology, and medicine.

- www.me.washington.edu/people/faculty/garbini/

Jiangyu Li



Jiangyu Li

Prof. Li's research interests are in the area of advanced multifunctional materials for sensing, actuation, energy harvesting and storage, and other emerging applications. He conducts research in the multi-scale modeling and simulation of ferro-electrics, ferromagnetism, multiferroics, and electro-active polymers, and composites. After joining the University of Washington faculty, he also started an experimental program focusing on processing and characterization of novel multifunctional materials and structures using nanoimprinting lithography, electrospinning, and piezoresponse force microscopy. His current research focuses on emerging energy materials, particularly thermoelectrics.

- http://mfml.me.washington.edu/

Peter Janicki speaks about energy issues at the ME graduation program in June.

Janicki's Entrepreneurship Covers Boat Hulls, Boeing, and Biomass

Peter Janicki held the rapt attention of attendees at June's ME graduation ceremony with a fascinating talk on energy issues and sustainability. With a nod to history, he traversed from steam power through the heavy fossil-fuel dependency of the last century, and then into the exciting potential for sustainable alternative energy solutions. As president and CEO of Janicki Industries, an innovator and world leader in large composite tooling, he is now leading his company into the alternative energy sector.

It's all happening in Sedro-Woolley, where Janicki was born and raised, the second youngest of eight children. His dad owned a small logging company, and as a child Janicki learned to drive bulldozers, fell timber, and shoot dynamite.

"After being nearly killed several times, I decided to go to college," Janicki said. He graduated from Notre Dame with a BS in civil engineering and then earned an MS in mechanical engineering from the UW in 1989.

An engineering position with ElectroImpact in Seattle provided experience building large-assembly automation equipment for commercial aircraft companies. After three years, his rural roots and family ties drew him back to Sedro-Woolley, where he and his wife, Susan, and their five sons live on a 40-acre farm complete with sheep, horses, and pheasants. Janicki was determined to merge a rural lifestyle with a high-tech entrepreneurial career.

While exploring ideas for his new company, Janicki visited a recreational boat builder in the area to learn how hulls were manufactured. "I realized I could use my engineering skills to vastly improve the slow, labor-intensive process for machining molds for the yacht hulls," Janicki said. Boat builders worldwide now use his custom-designed, automated milling machines. His company has carved molds for craft ranging from high-performance kayaks to luxury megayachts, and several high-tech boats that have competed in the Americas Cup races.

A new challenge came along when Boeing decided to build its next-generation commercial airliner with composites.

Janicki won the contract to design and make the tools and molds for the various fuselage sections of the 787 Dreamliner. Boeing's production partners wrap carbon-fiber fabric around the drum-shaped molds and harden it to create the sections. Now Janicki Industries employs 500 people, and also counts Lockheed, Northrop Grumman, NASA, Pratt and Whitney, and GE among its 1000 active customers.

Janicki leads company research and development and is working on a design for biomass-fueled steam engines that could power buses, trucks, and cars and help ease dependence on oil. Whether by land, sea, or sky, Janicki is helping transform how we get where we need to go.

ME Alumni — We'd love to hear from you

Let us know where you are and what you are doing. Submit alumni news and address updates by completing the alumni information form available on our website at http://www.me.washington.edu/people/alumni. You can also give us your news by contacting Curt Fritsch by phone at 206-685-6993, by email at measstch@u.washington.edu, or by mail at Dept. of Mechanical Engineering, University of Washington, Box 352600, Seattle, WA 98195-2600.

Olson Awarded Dean's Medal

Kristina Olson, student speaker at ME's graduation ceremony, was one of two seniors to win the 2008 College of Engineering Dean's Medal. The award honored her academic excellence, research and industry experience, and campus and community involvement. Olson received her BSME degree summa cum laude and was a member of Phi Eta Sigma National Honor Society.

In addition to ME coursework, she spent six months on an engineering co-op at Stantec, a multiservice design, planning, and engineering firm, where she pursued her interests in mechanical building systems, energy efficiency, and sustainability.

Throughout her four years at UW, Olson competed as a member of the UW Speech and Debate Society and as a senior served as its vice president with responsibility for finances. She also has a passion for drawing and diversified her course schedule by taking several UW art classes.

Olson recently joined Microsoft. After completing a training program she will be a software test engineer with the Internet Information Services unit. Congratulations Kristina!

Recycle Bins for Ferries May See Statewide Use

Recycle bins designed by ME 495 class in use on Washington State ferries.

In March 2006 Captain Kelly Mitchell, Washington State Ferries (WSF) senior port captain, contacted Prof. Vipin Kumar with a proposal. New trash/recycle receptacles with special requirements were needed for ferries and ferry terminals. Would Kumar's students be interested in submitting designs for these receptacles? WSF wanted three separate metal receptacles for trash, aluminum cans, and newspapers, with capacity limited to 40 pounds and a design capable of being manufactured by Washington State Correctional Industries. For security, openings on top were to be small and the lid had to be latched to prevent someone from opening the top and inserting a backpack or similar object.

Dawn Tara Parks, Jeremy Chio, and Hokuto Ueda, students in Kumar's ME 495 class, took up the challenge. Before beginning design work, the team visited ferries and terminals to understand the requirements and Correctional Industries to ascertain their manufacturing capabilities.

The team worked long hours developing a design to meet all specifications. They submitted their final design in June 2006. From the outside, their design looks conventional. However, it has small openings for trash, cans, and newspapers. The top has a hidden hinge inside, which only the crew can open. Workers remove collection bags through a front opening door, eliminating shoulder injuries from trying to lift a heavy bag up through the receptacle top.

Captain Mitchell and WSF accepted the design and began the process of construction and installation. This took almost two years, as Correctional Industries was limited in production capacity to 40 units per month, and WSF required 400 sets of receptacles. The WSF installation was completed by Summer 2008. Correctional Industries saw the design as so successful that they asked permission to continue production and to "market" the product to other state agencies. ▪

Honors & Awards

- Mark Tuttle will receive the 2009 Tatnall Award from the Society for Experimental Mechanics at SEM's Annual Conference in June, 2009.
- Minoru Taya and Wei-Chih Wang were both featured in an article on smart materials in the May 2008 issue ***Horizon Air Magazine***.
- Eric Seibel and PhD student Woon Jong Yoon received an award from UW Tech-Transfer to build a working prototype of a unique remote-controlled cytoscope for scanning the interior surface of the bladder for cancerous tumors.
- Jim Riley has been invited as a senior visiting fellow at the prestigious Isaac Newton Institute for Mathematical Sciences in Cambridge, UK.
- Peter Dahl has been elected to the six-member executive council of the Acoustical Society of America.
- Jiangyu Li has been promoted to associate professor.
- Chunye Xu and Minoru Taya received a UW TechTransfer award to design a tactile sensor array for use in orthotics, prosthetics, and cosmetic enhancements.
- Colin Daly and ME staff lab engineer Bill Kuykendall watched with pride the recent activation of the Large Hadron Collider in Geneva, Switzerland. Both played a central role in designing and fabricating one of six particle physics experiments that will be conducted in the collider.
- Per Reinhall and Peter Dahl won a Washington State Department of Transportation award to make pile driving in water less noisy and to prevent fish kills.
- Vipin Kumar was conference chair for FOAMS 2008, the 6th International Conference on Foam Processing and Technology, held in Charlotte, North Carolina on September 10 and 11. UW presenters included Wei Li, Vipin Kumar, PhD candidate Dustin Miller, and Xiaoxi Wang, PhD '07.

Welcome to Amy Shen

Amy Shen

Associate Professor Amy Q. Shen joined the faculty on September 1, following six years as assistant professor at Washington University in St. Louis. She earned her PhD in theoretical and applied mechanics (2000) and MS in civil and environmental engineering (1996) at University of Illinois at Urbana–Champaign. She holds an MS from Tongji University (1994) and BS (1992) from Hunan University, both in engineering mechanics.

Prof. Shen's research program centers on complex fluids and the processing of these materials to create morphologies and structures that can find application in nanotechnology, biotechnology, microelectronics, and energy-related materials. Within this broad area, her laboratory takes advantage of the coupling of complex fluid microstructures with spatial confinement that is possible by using microfluidic flow methods to offer morphological control of soft materials. These strategies lead to flow-induced nano-materials useful in energy applications, biomimetics, biosensors/actuators, and bio-MEMS. ▪

Human Powered Submarine 2008

The Human Powered Submarine team spent the year designing, building and testing their submarine in preparation for the 2008 competition in Escondido, California. The team was eager to match their submarine against the other entries. All of the team's preparation and expectation turned to disappointment when the competition was cancelled at the last minute due to basin problems at the competition site. Despite having to forego the experience of competing in their submarine, the team gained valuable experience from the pre-competition phase, applying their knowledge and creativity and learning to work together in small groups and as a team.

2008-09 human powered sub team.

2008 FSAE West Competition

Competition preparation

Gravity test

The first two days of the 2008 FSAE West Competition in California were devoted to static tests and presentations. Our Team 19 qualified for the design finals and placed 2nd overall in design. On day three in the autocross, the first dynamic event, UW placed a very solid 5th place. With the endurance and fuel economy runs on the schedule for the final day, the team was poised for an excellent finish. However, on the final endurance run, with only a few laps to go, the engine quit and refused to restart. This was very disappointing but, with the strong showing on the first three days and the first endurance run, the team placed 17th overall.

UW Formula SAE is building its 20th car this year!

To acknowledge the alumni who made this program such a success, the team would like to create an alumni network to celebrate this accomplishment and build an alumni resource for future teams. If you were part of a team in the past, please contact April Johnson at 206-543-8779 or by e-mail at aprijohn@u.washington.edu.

ME Website: www.me.washington.edu / ME Main Office: 206.543.5090

UNIVERSITY OF WASHINGTON
COLLEGE *of* ENGINEERING *Mechanical Engineering*

The MEssenger

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