Mechanical Engineering

Spring 2010

The MEssenger

UNIVERSITY OF WASHINGTON
COLLEGE of ENGINEERING
A Community of Innovators

ME Students Tackle Husky Stadium Camera Vibration

© Jack Hoffman

Jeff Siegmeth taking vibration measurements on Husky Stadium camera platform.

A Mechanical Engineering student at UW spends two years taking courses on theory and solving problems on homework, quizzes, and tests. However, it is only when this knowledge is applied to solving real-world problems that the student becomes an engineer. ME 395, Introduction to Design, gives students exactly this opportunity. Last autumn, ME 395 students worked on such a problem right here in their own backyard.

While watching Husky games on TV, Jeff Siegmeth, BSME '03, noticed a shaking in the picture during times when the crowd was making noise, causing the stadium to vibrate. When the stadium vibrates, the camera platform vibrates, affecting the picture. Having enjoyed the study of dynamics while at UW, Jeff thought ME students might be able to solve the problem. He contacted Per Reinhall, a professor from his undergraduate days, to discuss the problem. Reinhall agreed. They contacted Prof. Vipin Kumar, ME 395 instructor for fall quarter 2009, who saw this problem as an excellent opportunity for his students.

"The goal of this class," Kumar explained, is to teach students the basic design process and to increase their awareness of the broader societal context of design, such as risk, liability, and ethics. The first step in the process is identifying a need." In this case, the need was reducing or eliminating the vibration affecting the cameras. Of the 60 students in the class, sixteen volunteered for this project. They were formed into four teams of four students each. Corey Pollock (Team A3), VJ Valeriano (Team D1), Charles Callahan (Team C3), and Hong Ly (Team D3) were selected as team leaders for the four teams. The teams, working independently, were each tasked with coming up with three

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News Flash

ME students winners in UW Environmental Innovation Challenge

Details in the Autumn 2010 issue of... *The MEssenger*

Algae Studied for Wastewater Treatment

© Heather Dillon

Algae absorbing pharmaceutical waste as they grow.

Algae are one of the more promising sources of feedstock for liquid biofuels. These have the potential to replace our dependence on petroleum as a source of liquid transportation fuels. Petroleum fuels are valuable due to their high energy density, their ease of use, and low cost. Algae-based biofuels also have high energy density and are easily compatible with diesel engines and gas turbines. They produce oil at a much higher rate per acre than any other biofuel. The critical question is whether these fuels can be produced and processed without their cost becoming so high as to make them commercially nonviable. Thus the challenge is to develop inexpensive, robust growth and extraction/processing technologies for algae-based biofuels.

Since our report in the autumn 2009 *MEssenger*, Prof. Mescher and graduate student Dara Farrell have developed a facility for growing larger amounts of algae. It provides a controlled temperature (heating in winter, cooling if needed in summer), controlled artificial lighting, and a controlled CO_2

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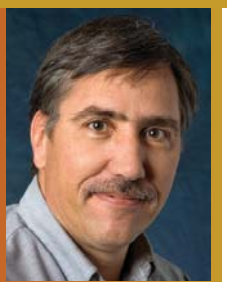
In this issue

Chair's Corner

ME Chair



Mark Tuttle

Greetings from the University of Washington campus. We are nearing the end of the 2009–10 academic year, with Spring Commencement just a few weeks away. I am pleased to announce that Jim Skaggs (BSME '59) will be the speaker during ME's graduation ceremony. As further described on page 6, Jim's 40-year career included leadership positions in the aerospace, computer, and electronics industries. I look forward to hearing his words of wisdom and advice for our 2010 graduates.

The department has hosted an ME Leadership Seminar Series every winter quarter since 2006. The primary goal is to demonstrate the breadth of career opportunities available to ME graduates. More than 40 alumni have spoken to students since 2006, collectively representing a wide array of career paths. This year's Leadership Seminar speakers are listed below. We appreciate the time they spent engaging with our students.

In my Chair's Corner last fall I briefly described the challenges the department faces related to severe state budget cuts. A further 5% cut in state funding appears likely for next year, in addition to the 10% cut we absorbed this year. Despite these steep cuts, I do not think the department will be forced to further reduce the number of teaching assistants, to cancel any more classes, or to lay off any additional staff or faculty. We should be able to maintain our current undergraduate student enrollment levels, although skyrocketing student demand forces us to turn away an increasing number of otherwise deserving applicants.

We are able to avoid further cuts to our program due to an increased reliance on non-state funding, primarily overhead funds derived from research expenditures. The success of various research centers and labs led by ME faculty has contributed to growth in research funding. Activities of the Center for Intelligent Materials and Systems (CIMS) and the center for Advanced Materials in Transport Aircraft Structures (AMTAS) were described in the autumn '09 issue of *The MEssenger*. In this issue we highlight the Applied Biomechanics Lab (ABL) led by Prof. Randy Ching and the Northwest National Marine Renewable Energy Center (NNMREC) led by Prof. Phil Malte. The ABL and NNMREC are two examples of a fundamental objective of the ME Department—to pursue research that will ultimately advance the well-being of society.

2010 ME Leadership Series

Special thanks to the following alumni for participating in our Leadership Seminar series:

John Purvis, BSME '59, BSIE '61
Director of Air Safety Investigation
Boeing, retired

Blair Erbstoeszer, MSME '99
Principal Mechanical Engineer
Cardiac Rhythm Management Office
Boston Scientific

Jan Kordel, BSME '89, MSME '91
Senior Design Engineer
Boeing Commercial Airplanes

Scott Korthuis, BSME '82
Product Manager, Oxbo International Corp.
Mayor, City of Lynden, Washington

Krishna Nadella, MSME '02, PhD '09
Co-founder, Vice President and CTO
MicroGREEN Polymers, Inc.

Kirk Lupkes, MSME '97
Mechanical Team Lead
Ramgen Power Systems

Ron Ho, BSME '86, MSME '89
President and CEO
U-Systems, Inc.

Carol Bubar, BSME '87
Chief of Staff, Hardware Division
Microsoft Corporation

This seminar brings ME alumni to campus to share their career and leadership experience in different fields. To learn more about the ME Leadership Seminar, contact April Johnson by phone at 206-543-8779 or e-mail, aprijohn@u.washington.edu.

Husky Stadium Vibration

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different concepts for solving the vibration problem, then selecting the one they considered the best solution.

"Before looking at possible solutions to the problem, we first had to examine the objectives and the constraints," said Pollock. Different teams chose different objectives. "From Jeff's measurements, we knew the frequency and amplitude of the vibrations," said Charles Callahan. "Our team set as its goal elimination of 90% of the amplitude of the vibration." Team D1 set its goal as reducing at least 50% of the vibration, but purposefully not trying to eliminate it. "Some vibration is good because it shows the excitement of the crowd," Valeriano explained. Some of the constraints identified by the teams included time, money, the need for any solution to be compatible with existing TV cameras, and a solution that did not block the field of view of the cameras.

Many ways of attacking the problem were suggested, including building a new camera platform, reinforcing the existing platform, fixing the tripods holding the cameras, and insulating the camera itself from the vibrations. The teams applied all the knowledge and skills they had acquired in previous ME classes in evaluating various solutions. Material properties were explored and finite element analysis used in the search for materials that would dampen vibrations. The teams used SolidWorks and Matlab software programs to model parts and show how various components fit together.

"It was a big leap going from the engineering theory learned in the classroom to application on a real-world problem where there is no single right answer," said Valeriano. The teams discussed many solutions before deciding on their final proposals. They made oral presentations and submitted written reports at the end of the course.

Each team came up with a unique conceptual design. The concepts ranged from various types of spring damper systems for the camera or the tripod to a rubber mat placed under the camera. As the various concepts showed, a number of solutions might work.

Was the class of value? According to Callaghan, "Any opportunity to solve a real engineering problem is great.

I honestly believe we don't get enough of those. In this class we gained experience in working with a group and in following the design process from beginning to the end."

Because the aim of ME 395 is to develop conceptual designs, not prototypes, the camera vibration is still there. According to Kumar, these projects may not end at this stage. The concepts may be pursued further in ME 495, Mechanical Engineering Design. One or more of the concepts could be developed, tested, and, if successful, that bothersome camera vibration could become a thing of the past.

In Memoriam: James B. Morrison

The department lost a gifted teacher, valued colleague, and friend with the passing of Prof. James B. Morrison on October 31, 2009. Morrison joined the general engineering faculty in 1946 and transferred to mechanical engineering as an instructor in 1947. He retired in 1983 as a full professor.

Morrison, a native of Virginia, was studying mechanical engineering at Virginia Tech when Pearl Harbor was attacked. He enlisted in the Army Air Corps, with service delayed until graduation. He received his BSME and entered the service in 1943. After training, he was assigned to a B-29 photo-reconnaissance unit in China as a flight engineer. On February 2, 1945, the crew of his B-29 bailed out of their disabled plane over Japanese-occupied northeastern China. The entire crew of 11 was rescued by Chinese Communist guerillas, who proceeded to hide them from Japanese troops and escort them on a 101-day, 850-mile journey to Yenan, headquarters for Mao Tse Tung's forces. Morrison acknowledged a debt to these courageous Chinese, a debt that he knew he could never repay. Upon returning to the U.S. he resolved to use his energies to repay humanity in general.

After the war Morrison took a job with the Boeing Company in Seattle and contacted the University of Washington about pursuing an advanced degree. Because of his education and experience, he was hired on the spot to teach general engineering to the flood of returning veterans heading back to school on the GI Bill. During the next 37 years he would influence the lives and careers of thousands of aspiring engineers. Many remember him as the best teacher they ever had. Henry T. Schatz (BSME '64), president of General Plastics Manufacturing Company, Tacoma, recalled Morrison as the professor who taught him and other students to think analytically and to solve problems in engineering and in life. In 2004 Schatz honored Morrison with two major gifts to the department. He established the Professor James B. Morrison Endowed Scholarship in Mechanical Engineering to help educate undergraduate students, and the Professor James B. Morrison Endowed Chair in Mechanical Engineering to honor distinguished teachers following in Morrison's footsteps.

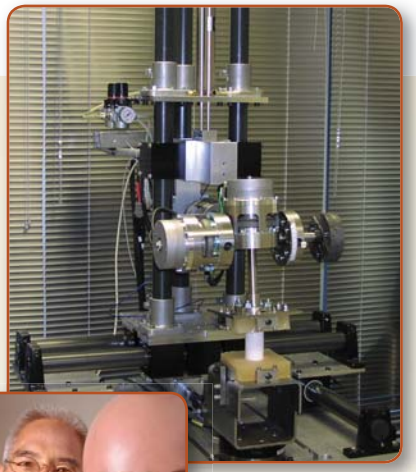
Lab group summer hike on Mt. Rainier.

Applied Biomechanics Lab: Making a Difference in Preventing Injuries

"Biomechanics" is engineering mechanics applied to biology. While biology is immensely broad, ranging from the smallest individual molecules to large complex organisms, the University of Washington Applied Biomechanics Laboratory's (UW-ABL) mission is to apply engineering principles to help prevent injuries and improve the quality of healthcare for people in Washington State and beyond. As a multidisciplinary research facility, the UW-ABL conducts a wide range of research projects in partnership with physicians from the UW School of Medicine, while also facilitating the education and training of students toward fulfilling its mission.

Randy Ching, director of the UW-ABL, joined the Department of Mechanical Engineering in 2002 after serving 10 years as a faculty member of the UW Department of Orthopaedics and Sports Medicine. By transferring to Mechanical Engineering, Ching returned to his "roots" where he completed his PhD in 1992. The UW-ABL staff includes two research engineers, Richard Harrington, and Amy Cohen, who provide lab continuity in a university research environment that is known to "graduate" its researchers. Since it's inception, the ABL has graduated eight PhD and seven master's engineering students.

In the area of injury prevention, the UW-ABL has concentrated much of its research efforts toward the protection of child vehicle occupants during car crashes. Over the past two decades, the leading cause of death in children under 18 years old has been motor vehicle crashes, surpassing all childhood diseases. Through support from the National Center for Injury Prevention and Control (Centers for Disease Control—CDC) and the National Highway Traffic Safety Administration (Department of Transportation—DOT), the UW-ABL has been working to help set federal motor vehicle safety standards in the area of pediatric head and neck injury. In addition, Ching serves on a national DOT task force that is charged with developing the design specifications for child crash-test dummies.



Above: Multi-axis biomechanical test frame used to evaluate new medical implants

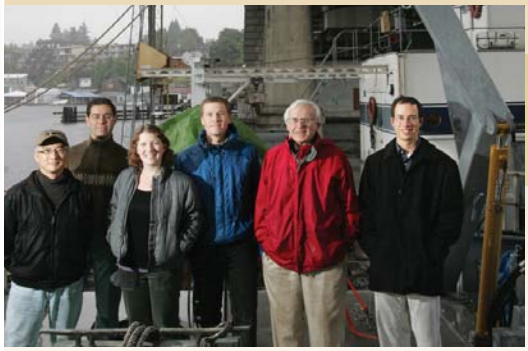
Left: Randy Ching with crash-test dummy.

Other injury prevention research projects conducted at the UW-ABL include the study of bicycle helmet effectiveness, impact-absorbing flooring to prevent fall-related injuries, child neck strength for establishing motocross helmet weights, and measuring window screen push-out forces related to child falls from multi-story buildings.

Since not all injuries and diseases are preventable, the UW-ABL is also actively engaged in studying new clinical diagnostics and treatments for improving healthcare. Early on, this area of research focused on total hip replacements, which have now become the standard of care for patients with hip fracture or arthritis. More recently, the lab has expanded its investigations to include total ankle replacement, pediatric knee implants (for children with bone cancer), and spinal arthroplasty devices (i.e., the replacement of diseased or herniated intervertebral discs).

This work is being sponsored by medical device companies that look to university laboratories to assist them with their research and development efforts. A custom-designed multi-axis biomechanical testing system (see photo at left) enables the UW-ABL to simulate the forces or movements made by the human musculoskeletal system to evaluate the efficacy of these new devices. Its study of total ankle replacement systems has resulted in a recent patent application for a new technology that can detect loose implants, the most common cause of patient discomfort and implant failure following surgery.

Whether preventing injuries or advancing their treatment, the UW Applied Biomechanics Laboratory is moving forward with engineering solutions to important healthcare issues. For more information, visit the UW-ABL website at: http://depts.washington.edu/uwabl/.



(L to R) Mitsuhiro Kawase (Oceanography faculty), Alberto Aliseda (ME faculty), Kristen Thyng (ME graduate researcher), Jim Thomson (APL/CEE faculty), Phil Malte (ME faculty), and Brian Polagye (ME faculty) aboard the Applied Physics Lab research vessel Jack Robertson. Not shown: Jim Riley (ME faculty), Brian Fabien (ME faculty), and Mark Tuttle (ME faculty).

Northwest National Marine Renewable Energy Center

Hydrokinetic tidal power is emerging as an exciting new source of renewable energy for the Puget Sound region. With no carbon emissions or visual expression, tidal turbines have the potential to turn the predictable power of tidal currents into green electricity. Tidal turbines extract power from moving water much in the same way as wind turbines do from moving air, and many tidal device concepts bear more than a passing resemblance to wind energy converters. The Northwest National Marine Renewable Energy Center (NNMREC) at the University of Washington is supporting the responsible development of this renewable resource in the United States.

NNMREC's tidal energy research brings together faculty and students from several academic units, including Mechanical Engineering, Oceanography, and the Applied Physics Laboratory. The UW center is directed by Prof. Phil Malte of the Mechanical Engineering Department. In addition to academic collaborators, the UW center involves a number of public and private partners: Snohomish Public Utility District, BioSonics, Sound and Sea Technology, Pacific Northwest National Lab (PNNL), and the National Renewable Energy Lab.

For over a year, the UW center has collected data to characterize the physical and biological environment in Admiralty Inlet, where Snohomish PUD proposes to deploy two OpenHydro turbines in 2012. The methods developed to study this particular site are being generalized for tidal energy sites throughout the United States. "The emphasis here is on learning," said Jim Thomson, a PI from the UW Applied Physics Lab (APL).

Data are being collected from aboard the APL research vessel *Jack Robertson*, on the seabed using an instrumentation tripod (shown below), and from the shore. Recently, ME graduate researcher Chris Bassett combined background noise recordings from the seabed tripod with ship traffic information to estimate how the noise from operating tidal turbines would propagate in Admiralty Inlet. Jeff Epler (ME graduate researcher) has developed a technique to combine shipboard and tripod measurements of velocity to map the intense tidal currents in the area.

(L to R) Sam Gooch and Chris Bassett (ME graduate researchers) and Dave Sutherland (Oceanography post doc) prepare the instrumentation tripod for deployment in Admiralty Inlet.

This summer, researchers will expand their monitoring activities under a new award from the US Department of Energy as part of a project team that includes Snohomish PUD, Sea Mammal Research Unit, Ltd., and PNNL.

Numerical modeling is also an important component of the UW center's activities. Researchers are using a set of validated models to investigate the potential effects that turbine wakes could have on marine life through changes to downstream sedimentation and mixing. Teymour Javaherchi (ME graduate researcher), presented preliminary results of this work at the annual AGU Ocean Sciences Meeting in Portland. Kristen Thyng (ME graduate researcher) is investigating dynamic flow behavior due to the rough underwater topography in Admiralty Inlet. Simplified numerical models are being employed to investigate stratification and the interactions between the shallow sills at the northern and southern ends of the inlet. These flow dynamics have potentially important implications for tidal turbine siting and operation.

The UW center recently hosted a workshop entitled "Environmental Effects of Tidal Energy." This workshop brought together more than seventy experts with diverse technical backgrounds. Participants, from Canada, Europe, and the U.S., helped identify approaches to close gaps in knowledge, monitor for effects, and mitigate stresses for areas of high priority environmental concern. Initial response was highly positive, with more than 90% reporting that they will use the information learned at the workshop for projects related to tidal energy.

For more information about NNMREC, including recent presentations in other areas of tidal energy research and videos from instrumentation deployments in Admiralty Inlet, please visit the UW center's website at http://depts.washington.edu/nnmrec.

Moon walk, 1969

A Mission Is Never Impossible With Jim Skaggs in Charge

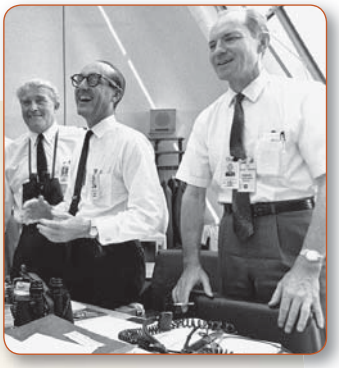
James Skaggs (BSME '59) has never met a responsibility he didn't welcome or a challenge he didn't relish, be it running a $23 billion NASA program or turning around a failing corporation. Over a career spanning four decades, he's amassed a trove of stories and life lessons to pass along to ME's 2010 graduating class. One highlight surely will be his contributions to putting a man on the moon. His imminent challenge is distilling his stories and insights into a 20-minute talk.

Skaggs hails from a family with pioneer roots deep in the heart of Texas. At the age of 12, this sixth-generation Texan moved with his family to Tacoma and in his first year here experienced a major earthquake and a winter blizzard leaving six- to ten-foot snowdrifts. "It seemed a sign of big changes ahead," he recalled.

At the UW he decided to major in engineering because he felt it would teach a logical thought process. "I chose ME because it covered a bit of everything. The logic training was more important to me than going into depth in one discipline," he said.

After graduation, Boeing hired him as the only mechanical engineer in the Minuteman missile program electronic design group. "It was wonderful to sit at a drawing board and design components and then so satisfying to see the hardware on the factory floor," he recalled. "As you move up the management ladder you never can get that same feeling."

A transfer into the Minuteman program management office proved a first-rate training ground for learning the correlation of budgets, project scheduling, and all aspects of program management. After five years at Boeing, a new opportunity knocked in 1964 when one of his Boeing mentors joined NASA's Apollo Program Control office in Washington, D.C., and invited him to come along. Boeing itself was heavily engaged in NASA's Apollo goal, set forth in 1961 by President Kennedy, to put an American on the moon and return by the end of the decade.



NASA officials are all smiles in the Cape Kennedy control center after the launch of Apollo 11 for the first lunar landing mission. Jim Skaggs was in a glassed-in room just a few feet away. From the right are: General Sam Phillips, Apollo program director and Skaggs's boss at the time; Dr. George Mueller, NASA associate administrator and head of Manned Space Flight; and Dr. Wernher von Braun, head of the Marshall Space Flight Center and responsible for launch vehicles. Skaggs later worked for von Braun when he came to Washington, D.C., to head future planning for NASA.

By age 30, Skaggs had rocketed up to director of Apollo Program Control, responsible for a $23 billion budget and planning, scheduling, contracting, logistics, and document management. Although he held the distinction of being the youngest person at that management level in the entire U.S. government, he was not in the least fazed.

"I thrived on responsibility and felt invigorated by challenge, based on a strong faith that you can make something happen if you believe it. When someone says 'impossible,' that just encourages me more," he said.

Jim and Betty Skaggs

At NASA's Huntsville center, Skaggs watched the huge screen as Neil Armstrong put the first foot to the moon's surface on July 20, 1969. "It was validation for years of hard work, great decisions by NASA leaders, and so many miracles. From time to time I still like to pull out the video to watch those last four minutes to landing," he said.

After several more successful moon missions, plus the Apollo 13 cliff-hanger, he moved on to the corporate sector, where his management, leadership, and problem-solving talents led to a succession of top positions at companies in New York, California, and Washington, D.C.

A return to his roots in Texas eventually led to his final executive position as chairman, CEO, and president of Tracor, a defense contractor on the brink of failure. He first downsized and refocused the company on its core business of developing automated systems used by military aircraft to counter an attack by an enemy missile. He then rebuilt Tracor into the nation's fastest growing major company in the defense industry, a $1.3 billion granddaddy of Austin's emerging high-tech sector. In 1994 he was honored as Austin's Entrepreneur of the Year. After nearly nine years at Tracor's helm, he arranged the sale of the company and retired in 1998.

Skaggs and his wife, Betty, whom he met at Boeing, are active in the Austin community. He serves on several nonprofit boards and is a leader in advocating practical and cost-effective solutions to Austin's regional transportation and land-use issues.

Inductees into Mechanical Enginering Hall of Fame in 2006. L to R: James Morrison, Donald Petersen, Albert Kobayashi

Kobayashi-Morrison Lectureship Planning Under Way

Thanks to the generosity of Paul M. Anderson (BSME '67) and other donors, we are able to begin planning for the first Kobayashi-Morrison Lecture in Mechanical Engineering. Plans are tentative at this point, but we hope to invite the first lecturer to campus during autumn quarter 2010. We plan to bring a distinguished mechanical engineer to campus for a two-day visit, during which he or she will deliver a lecture on a subject of general interest to the mechanical engineering community. The audience will include alumni, students, faculty, and interested members of the mechanical engineering profession. A reception will follow the presentation. During the visit the guest lecturer will also meet with student and faculty groups, visit research labs, and attend a few classes.

The Kobayashi-Morrison Lecture honors professors emerti Albert S. Kobayashi and the late James B. Morrison, who had distinguished careers on the ME faculty. Kobayashi, a world-renowned researcher in the field of fracture mechanics, retired in 1997 after a 39-year career at UW. Many of the graduate students he mentored achieved significant success in their own careers. Morrison (see story on page 3) is fondly remembered as an outstanding teacher who influenced the lives of hundreds of undergraduate students during his 37 years on the faculty.

The campaign to establish the Kobayashi-Morrison Lecture Fund is co-chaired by John Roundhill (BSME '67, MSME '73), and Savio Woo (MSME '66, PhD '71). You can participate by making a tax-deductible contribution to the lecture fund and by submitting a personal story and photos of experiences you had with either Morrison or Kobayashi. To submit a story or photos, visit http://www.engr.washington.edu/giving/me_endowed_lecture.html. To contribute, please contact April Johnson at 206-543-8779 or aprijohn@uw.edu.

We are excited about this opportunity to honor two of our most outstanding faculty while significantly enhancing the educational experience of our students and providing an informative presentation for alumni and friends. Additional information on the lecture will be forthcoming as planning progresses.

Honors, Awards & Transitions

Ping Ao left the faculty for a position as professor at Shanghai Jiao Tong University.

Jiangyu Li recently joined the editorial board of *Continuum and Thermodynamics*.

Wei (Wayne) Li left the faculty for a position as an associate professor at the University of Texas.

MicroGreen Polymers, co-founded by **Krishna Nadella** (PhD '09) won a $60,000 award in Zino Zillionaire Investment Funds from the Zino Society. Nadella was featured in the autumn '09 *MEssenger*.

In addition to being actively involved as associate editor for the *Journal of Fluid Mechanics* and for the *Journal of Turbulence*, **James J. Riley** joined the editorial committee for the *Annual Review of Fluid Mechanics*, and has become an associate editor for the *Applied Mechanics Reviews*.

Mark E. Tuttle was a member of a 12-person trade delegation that visited the Apulia region of the Italian peninsula from March 1 through 5, 2010. The objective of the event was to encourage and strengthen business ties between small- and medium-size US and Italian aerospace firms.

Chunye Xu left the faculty for a position as professor at the University of Science and Technology of China.

Graduate student **Woon-Hong Yeo**, mentored by **Jaehyun Chung**, received four awards for papers presented at ASME IMECE 2009 in Orlando and ASME 2010 NEMB in Houston.

Qingze Zou (PhD '03) recently received an NSF CAREER Award. He is an assistant professor at Iowa State University.

A proposal by a team of ten UW students, including ME undergraduates **Stephen Choi**, **James Coe**, **Jeff Rider**, and **Kyle Wetzlar,** has been accepted by NASA's 2010 Reduced Gravity Education Program. The team will conduct experiments with a novel model fuel tank on flights flown during the week of June 17 through 26, 2010.

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Send address corrections, questions, and comments to: Editor, ME Newsletter at the return address above.

James Riley

In collaboration with colleagues at Georgia Tech and the San Diego Supercomputer Center, James J. Riley has received a grant of computer resources from the U.S. Department of Energy Innovative and Novel Computational Impact on Theory and Experiment program, which promotes cutting-edge research that can only be conducted with state-of-the-art computers. The Leadership Computing Facilities at Argonne and Oak Ridge national laboratories, supported by the U.S. Department of Energy Office of Science, operate the program and award sizable allocations on powerful supercomputers to researchers from academia, government, and industry, addressing grand challenges in science and engineering. Riley's research addresses the grand challenge problem of turbulent mixing, which is of importance in energy efficiency, pollution control, oceanography, and the atmospheric sciences.

"Equi-distance Between Two Tori"

Mark Ganter

Mark Ganter won the Newcomer's Award at *e-merge 2010*, the sixth biennial juried kiln-glass exhibition for emerging artists. The *e-merge 2010* exhibition will be hosted at Bullseye Gallery in Portland, Oregon. Finalists' work will be on display at Bullseye Gallery, March 23 through June 19, 2010. The exhibition recognizes early career kiln-formed studio glass artists not yet represented by major galleries. All entries were judged for concept excellence, craftsmanship, and design. Finalists were chosen from more than 300 entries.

Algae Study

Continued from page 1

environment. Testing has examined the ability of algae to remove pharmaceutical residue from wastewater. Such residues appear in municipal wastewater, and are difficult for current wastewater plants to remove. Algae have been proposed as a means of removing nutrients from wastewater, and also potentially removing pharmaceutical residues before these waters are released.

Profs. Mescher and Kramlich were invited to speak on their extraction work at the Algal Biofuels Symposium sponsored by ExxonMobil Research and Engineering Company in Clinton, New Jersey in early March. They joined other speakers from Europe and the U.S. in presenting a picture of the state-of-the-art challenges and opportunities in making algae-based biofuels a commercial reality.