MECHANICAL ENGINEERING | UNIVERSITY of WASHINGTON SUMMER 2016

The MEssenger

NEWSLETTER

CHAIR'S MESSAGE

Greetings from UW Mechanical Engineering! I'm eager to share some exciting departmental updates in this newsletter. First, I'd like to acknowledge our outstanding faculty, several of whom received honors this year, which you'll read about below. We've welcomed three new faculty members (also highlighted here) whose expertise in robotics, manufacturing, clean energy and nanomaterials is vital to the department's growth.

We continue to be a leading department at the UW for patents and innovations, and our research is expanding particularly in the arenas of health technology and energy. Every day the future is developed in our labs, where students and faculty forge partnerships across campus and with government agencies and industry partners. This issue's feature story highlights the impact of BARC, one of these invaluable academic-industry collaborations.

We are committed to providing students with a world-class education and strive to increase diversity, inclusion and access in our classrooms, labs and programs. We're honored to celebrate our graduating students—nearly 160 bachelor's degrees, 68 master's and 21 doctoral degrees have been awarded in ME for 2015-16.

Best wishes for a wonderful summer! For more news, visit us online at me.washington.edu.

Per Reinhall
Mechanical Engineering Chair

Faculty News

Welcoming three new ME faculty members

In his research, **Ashis Banerjee** addresses challenges in optimal decision-making for autonomous systems that mimic human capabilities to achieve robust performance. He holds a joint appointment with Industrial & Systems Engineering.

A researcher at the intersection of robotics and biology, **Sawyer Fuller** creates biologically-inspired sensors, control systems and mechanical designs targeted at insect-sized air and ground vehicles, and investigates the flight systems of aerial insects.

An expert in emerging electronic materials, including organic semiconductors, nanomaterials, photovoltaics, thin film batteries and printing and flexible electronics, **J. Devin MacKenzie** holds a joint appointment with Materials Science & Engineering and the Clean Energy Institute.

Honors and Awards

Nicholas Boechler won an Air Force Young Investigator award for his work in Materials with Designed Nonlinearities: Enabling a New Generation of Stress Wave Transformation.

Ramulu Mamidala received an Excellence in Education award from the Telugu Association of North America. He was also elected to the Washington State Academy of Sciences.

Kat Steele and **Eric Seibel** were named recipients of the 2016 UW College of Engineering awards. Steele and Seibel received the Junior Faculty Award and Faculty Research Award, respectively.

Kat Steele also received the American Society of Biomechanics (ASB) Young Scientist Award. Her research focuses on improving movement for individuals with neurologic injuries.

Junlan Wang received the 2016 A.J. Durelli Award from the Society for Experimental Mechanics. Wang received this award for her contributions to the mechanics of nanomaterials, thin films, layered microstructures and multifunctional materials through innovations in experimental mechanics.

Clean, efficient cookstoves from ME-industry partnership to be manufactured in Kenya this summer

For much of the world's population, gathering fuel to cook food is a dangerous task. Women and children often journey miles from their homes to collect sticks and branches, exposing themselves to violent crime and other dangers in the natural environment.

Inside homes across the developing world, smoke from open cooking fires and polluting cookstoves is estimated to cause millions of premature deaths and lead to a range of illnesses.

A more efficient and clean wood-burning cookstove—developed by the Vashon Island-based non-profit BURN Design Lab in collaboration with UW mechanical engineers—will reduce the amount of fuel those families need to collect or purchase by 55 percent. It will also reduce exposure to the harmful particulate pollution produced by traditional cooking flames.

Thanks to a recent $800,000 investment from Unilever and Acumen, the new wood-burning cookstove design developed by Burn and ME will be manufactured in BURN Manufacturing's factory in Nairobi, Kenya this summer and sold across East Africa.

Compared to traditional cooking methods that balance a pot on three stones surrounded by open flame, the "Kuniokoa" cookstove is expected to reduce by 67 percent harmful pollution that increases the risk of contracting asthma, heart diseases and other health problems. It will also increase fuel efficiency and reduce deforestation, as it will lessen the amount of wood that must be collected for use.

The wood-burning stove that launches this summer will be sold to farmers and plantation workers on Unilever's tea estates in Kenya and Tanzania, at a cost of approximately $35 U.S. dollars.

As a bonus, it will also be manufactured locally in BURN Manufacturing's Kenyan factory, which employs roughly 100 people who currently produce a separate line of clean-burning charcoal stoves.

At the UW, this project is led by ME faculty Jonathan Posner and John Kramlich through the Clean Cookstove Lab. Learn more at cleancookstoves.uw.edu

'Walk-DMC' aims to improve surgery outcomes for children with cerebral palsy

Children with cerebral palsy frequently undergo invasive surgeries—lengthening tendons, rotating bones, transferring muscles to new locations—in hopes of improving their physical ability to walk or move.

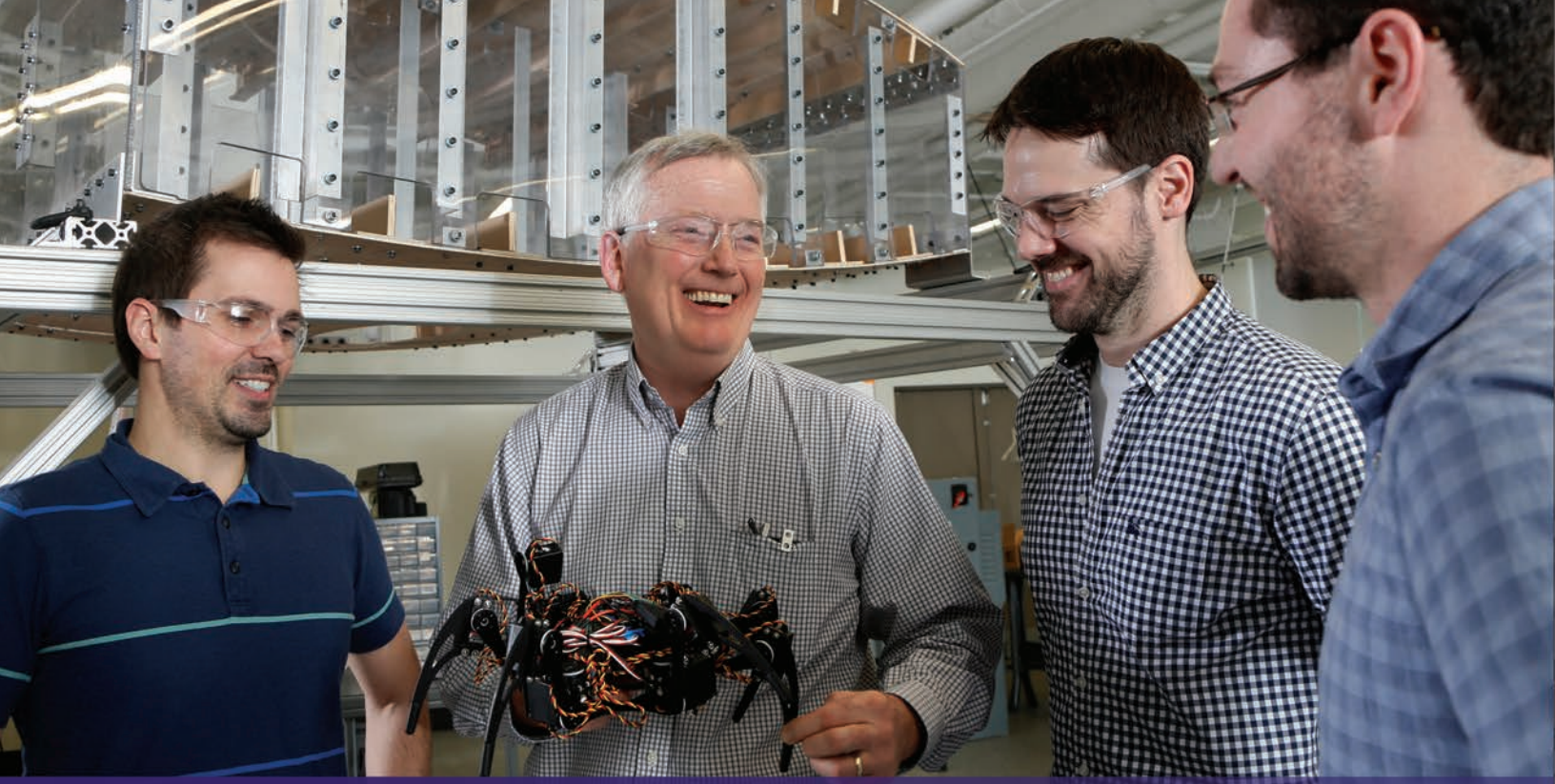
While the operations work well for some patients, other children see little to no improvement.

In collaboration with partners from Gillette Children's Specialty Healthcare, UW ME researchers have developed a new quantitative assessment of motor control in children with cerebral palsy called Walk-DMC, which could help predict which patients are—or are not—likely to benefit from treatment.

"Only about 50 percent of children have significant improvement in their movement after these highly invasive surgeries," said Kat Steele, ME assistant professor. "Our motivation has really been to figure out how we can push up these success rates."

The new measure is based on electromyography data, which uses electrodes to monitor muscle activity (EMG demonstration pictured). Historically, doctors have relied on experience and more subjective clinical measures to evaluate a patient's motor control.

The team recently won a $1.5 million grant from the National Institute of Neurological Disorders and Stroke to further evaluate Walk-DMC's potential in clinical settings. Their next steps include analyzing whether motor control can change after treatment, and working to expand options for children who are less likely to be good surgical candidates.



A riveting combination: The UW and Boeing advance research together through BARC

The brainchild of an ME alumnus-turned-Boeing engineer and two faculty members, BARC presents a unique path for university-industry collaboration.

In most engineering labs on university campuses across the country, it's not every day that students get to work alongside leading industry engineers.

Unless you're an engineering student in the Boeing Advanced Research Center, or BARC, as it's known at the UW.

Opened in January 2015 and housed in the mechanical engineering (ME) building, the 4,300 square-foot facility pairs full-time Boeing engineers with students and professors to come up with solutions for Boeing projects. Though The Boeing Company and the UW have a long history of collaboration, this is the first time the two have worked together in a shared facility on campus.

An agreement between Boeing and the UW College of Engineering, BARC is the brainchild of Jim Buttrick, '84 MS, a Boeing engineer and the center's associate director, and ME professors Per Reinhall and Joseph Garbini. After many years of working in industry, Buttrick saw a good opportunity for students to gain practical, hands-on experience and Boeing to benefit more directly from researchers.

"The student experience within BARC provides outstanding preparation for real-world, hands-on jobs," Buttrick explains. "Rather than send students off-campus, it allows industry to come to the students. It's an innovative approach to higher education and industry partnership."

This arrangement speeds up the process for students to transition from an academic to an industrial work environment. Currently more than 7,400 UW alumni are employed by The Boeing Company in Washington state, and of that number, nearly 1,200 hold mechanical engineering degrees.

An innovative model

"The establishment of BARC represents a new paradigm in industrial research at the UW," says Reinhall, who also serves as one of the center's co-directors.

When BARC opened, eight full-time Boeing engineers moved to the UW lab space as affiliate instructors. Eight graduate students and six faculty joined the group. Since then, the team has grown to include two undergraduates and three additional Boeing engineers who are also working on advanced degrees at the UW.

So far, priority projects have focused on automation, robotics and aircraft assembly. "Overall, we're interested in long-term improvements in the way we build airplanes. To start, we strategically chose projects where we want to solve a problem, but we see there are areas where we can employ academic talent to work portions of a project and come up with viable solutions," Buttrick says.

One of the lab's key projects is designed to make it easier for mechanics to access, build and repair the insides of airplane wings—shallow, narrow spaces where it is physically difficult to work. Other projects include automating the riveting of fuselages and predicting the final shape and size of certain aircraft structures.

Down the road, BARC plans to expand projects across the College into areas such as aeronautics and astronautics, chemical engineering, materials science, electrical engineering and computer science and engineering.

For first-year ME Ph.D. student Rose Hendrix, who researches industrial applications in augmented reality, BARC has provided an invaluable opportunity. "Boeing employees bring a high level of expertise, and it's been great to tap into their knowledge daily," she says. "We've also had the opportunity to tour Boeing facilities and meet people who we likely wouldn't have had access to were it not for BARC."

While students receive a more practical, hands-on experience, Boeing engineers gain access to fresh ideas and new research. Plus, Buttrick says, the students' enthusiasm for real-world problem-solving can be very inspiring.

Of course, it's not easy. One of the biggest challenges has been negotiating the different motivating factors that drive industrial and academic research. Prior to the center's launch, Boeing, UW and College of Engineering leadership created a research master agreement to govern BARC. Yet since the center is not modelled after traditional grants-funded labs, its team must constantly evaluate structure and workflow.

BARC team members must meet project deadlines set by Boeing. "I've been asked if this puts unnecessary stress on students," says Buttrick. "But I think learning how to react and adapt to industry-driven deadlines is one of the most important lessons we can teach students to prepare them for the working world they'll enter after graduating."

UW students and faculty and Boeing engineers will have a positive impact on occupational safety and quality of work environment for airplane workers.

"We get to have some of the most significant airplane manufacturing and design issues come through this lab," Reinhall says. "It supports an exciting new trend in education where students learn by doing, along with close interaction with industry."

> **"The student experience within BARC provides outstanding preparation for real-world, hands-on jobs."**
>
> *Jim Buttrick, BARC associate director*

BARC's reach has extended into the College's curriculum as well. This winter, the ME department offered Structural Engineering in Commercial Aircraft, a course for upper-level undergraduates and graduate students. Co-taught by UW faculty and Boeing engineers, the course provided an overview of major structural components,

Real-world impact

Buttrick remembers that when he enrolled at the UW in the early 1980s, he couldn't wait to begin tackling real world problems in his engineering classes. He soon discovered that he would have to wait until completing his degree and landing a job to get that experience.

Thanks to centers like BARC, this is not the case for students today.

"Being at BARC allows me to actively work on things that people will directly benefit from," says Hendrix. "We're coming up with applications that address real-world problems and drive specific solutions, and that's really exciting."

As it continues to grow, BARC will have a direct impact on the way aircrafts are designed and assembled. The innovations being developed in collaboration between product development and certification, damage tolerance and factory/fleet support.

This convergence of academic and translational research exemplifies the ME department's culture of innovation and commercialization. "We seek to meet industry needs by not only providing trained and skilled graduates for the workforce but by translating the expertise of our faculty into impact," explains Reinhall.

For Buttrick, the center also represents something more personal.

"BARC has been an incredible way for me to give back to the UW," he says. "Joe Garbini and Per Reinhall were both young professors when I was a student here, and it's been great to come full circle and work with them to make BARC a reality for students and faculty."

Find out more at me.washington.edu/BARC

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BOEING ADVANCED RESEARCH CENTER

ME undergrad presents wrist orthoses research at Posters on the Hill in D.C.

ME senior and Levinson Scholar Alexandra "Sasha" Portnova presented at the 20th annual Posters on the Hill this April in Washington, D.C. Hosted by the Council on Undergraduate Research, this poster session gives undergraduates the opportunity to share research with senators, congressional representatives and staff, federal agency officers and reporters.

Portnova's was one of 60 posters chosen from hundreds of applications. She presented her work on improving the design of affordable, 3-D printed wrist-driven orthoses (WDOs) for individuals with spinal cord injury.

WDOs are used by individuals who have strength in some of their wrist muscles but little to no mobility in their fingers. WDOs on the market currently take time to produce. For the wearer, they can be uncomfortable and expensive.

"My goal is to use 3-D printing to improve comfort, aesthetics and functionality of WDOs while reducing the time it takes to make them," Portnova explains. "I also want to make them open source so they can be accessible to anyone."

Working closely with ME assistant professor Kat Steele in the UW's Ability & Innovation Lab and Ann Yamane in Prosthetics & Orthotics at UW Medicine, Portnova designed a 3-D printed device. She then asked orthotists and users from the UW's Medical Center to test and provide feedback.

The results are impressive: not only has she decreased the assembly time (from 20+ hours to approximately 1.5 hours), but her custom-fit WDO is considerably lighter than traditional metal versions. In addition to better overall performance, it allows wearers to achieve a new type of grasp.

Portnova says the most rewarding part of her work has been when subjects ask to take their 3-D printed orthoses home after using them in the clinic. For her, users are just as crucial to the design process as researchers.

"Engineers come up with great ideas, but that's not always enough—especially when it comes to prosthetics and orthotics," she says. "People who are going to be using these devices daily need to be involved from the start. Their feedback is everything."

This fall, Portnova will start a Ph.D. program at Northwestern University, where she plans to continue biomechanics research. She hopes to learn controls in addition to design.Though looking forward to graduate school, she will miss the UW ME community. "My advisors, instructors and classmates are all so accessible and supportive. I've really felt like part of a family here."

Graduate student achievements

Mark Jankauski received the 2016 UW College of Engineering's Student Teaching Award. Since 2013, he has taught undergraduate level kinematics and dynamics classes and graduate level courses in dynamics and vibrations.

Gaurav Mukherjee joined the 2016 Emerging Leaders in Science & Society. His research focuses on creating enhanced hand orthoses for individuals with impaired hand function. He is also a 2014-16 UW Institute for Neuroengineering Fellow.

Curtis Rusch received a 2016 NSF Graduate Research Fellowship Program award for his work on wave energy converters, which he hopes will lead to more efficient conversion of ocean waves to usable electricity.

Ben Shuman was selected as a 2015-17 Graduate Fellow for the UW Institute for Neuroengineering. His research uses quantitative assessment of muscle activations to determine if patients with cerebral palsy may benefit from intensive treatment.

Alumna Sally Jewell gives 2016 UW commencement speech

U.S. Secretary of the Interior and ME alumna Sally Jewell, '78 BS, was the featured speaker at the UW's commencement exercises on Saturday, June 11.

Jewell was sworn in on April 12, 2013, as the 51st Secretary of the Interior, leading an agency with more than 70,000 employees. Prior to her Interior appointment, Jewell served as president and CEO of REI, having been named to that position in 2005 after five years as the company's chief operating officer. She is also a former member of the UW Board of Regents, serving in various capacities from 2001 to 2013.

This year Jewell was also acknowledged by the UW with the Alumna Summa Laude Dignata (ASLD) award. The highest award the UW and the UW Alumni Association can bestow upon a graduate, it is presented annually to a former student whose achievements have earned her or him national or international acclaim.

"Sally Jewell epitomizes what we hope for our graduates each year—that they will leave the University and embark upon a career that will change lives and change the world," UW President Ana Mari Cauce said. "She has excelled at everything she has done, and the fact that she is one of our own makes it even more special."

Dave Marver delivers 2016 ME graduation address

We thank Dave Marver for delivering remarks at ME's 2016 graduation ceremony on June 12. Marver is CEO and co-founder of VICIS, a company spun off from UW ME research that has developed an innovative helmet designed to mitigate the forces thought to cause concussions on the football field and in other contact sports.

Marver has previously held leadership positions at Cardiac Science Corporation and Medtronic, Inc., and has served on the Medtech Advisory Board for the World Bank's International Finance Corporation. He also serves on the Investment Committee for the W Fund, which provides venture capital for startups born of UW research and development.

An accomplished entrepreneur and business leader, Marver shared with the ME Class of '16 his perspectives on mechanical engineers in the business world.

ME External Advisory Board

We wish to thank the following alumni and friends for participating on this year's external advisory board:

David Barr, Director, Boeing Programs, Hexcel
Jon Bishay, Bardy Diagnostics
Anders Brown, '92 BS, '94 MS, President, Radius, Inc.
Steve Chisholm, '86 BS, The Boeing Company
Martin L. Dunn, '89 MS, '92 Ph.D., Victor Schelke Professor and Associate Dean for Research, University of Colorado at Boulder
Stanley Gent, President and CEO, Seattle Steam Company
Carl Hergart, Director of Advanced Powertrain, PACCAR
Peter W. Janicki, '89 MS, President and CEO, Janicki Industries, Inc.
Michael C. Kintner-Meyer, '94 Ph.D., Energy-Environment Directorate, Pacific Northwest National Laboratory
Paul Leonard, Engineering Director, VICIS, Inc.
Tom Loutzenheiser, '83 BS, Executive Vice President of Business Development, PRECO Electronics
Jill McCallum, President, Pacific Rim Aerospace Corporation
Hamid Mortazavi, '82 MS, '89 Ph.D., Research Specialist, SEMS/Corporate Research Lab
Ron Prosser, '70 BS, Chairman and CEO, Green Charge Networks
James M. Reichman, PACCAR, Inc. (retired)
Donald Sandoval, '91 MS, '95 Ph.D., Senior Research Physicist, Los Alamos National Laboratory
Robert K. Schneider, '74 BA, President, D. Hittle & Associates, Inc.
K. Michael Sekins, '81 Ph.D., Director of Applications, Innovations Department, Ultrasound Division, Siemens Medical Solutions USA, Inc.
Fred Silverstein, '72 M.D., UW Clinical Professor of Medicine, Gastroenterology, and General Partner, Frazier & Co. (retired)
John T. Slattery, Vice Dean for Research and Graduate Education, UW School of Medicine
Tim Stearns, '90 BA, Senior Energy Policy Specialist, State Energy Office, Washington State Dept. of Commerce
Al Stephan, '82 BS, CEO, Stratos Biosystems LLC
Tina Toburen, '92 BS, '94 MS, T2E3 – Energy Efficiency Enterprises
Gil Wootton, '89 BS, Accenture

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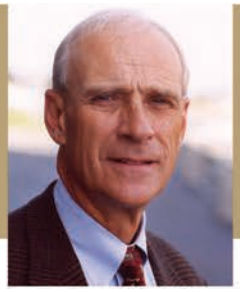
Alumni honored with 2016 Diamond Awards



Please join us in congratulating three ME alumni who have been honored for achievements by the UW College of Engineering with 2016 Diamond Awards:

Dean's Award: **Frank Jungers,** '47 BS

During his 31-year career at Arabian-American Oil Company (now Armaco), Frank Jungers was an influential figure at critical moments in the development of the Middle East oil industry. Since retiring, he has served on the boards of several Fortune 100 companies.

Entrepreneurial Excellence: **Peter Janicki,** '89 MS

Peter Janicki's pioneering work in composite tooling has transformed the aerospace, wind energy and transportation industries. In a partnership with the Gates Foundation, he developed the Omni Processor, a revolutionary device to redefine water sanitation in the developing world.

Distinguished Service: **Ron Crockett,** '61 BS

As the founder of multiple successful companies, Ron Crockett is known for his business acumen, but some of his most remarkable contributions are in service to higher education. He attended the UW with scholarship support and has since been committed to helping students succeed.

Learn more at engr.uw.edu/da

2015-16 ME Leadership Seminar Series

Many thanks to the following alumni and friends for participating in this year's leadership seminar series:

Ash Awad, '94 MS, Chief Market Officer, McKinstry
Tony Crawford, M.D., '96 BS, Attending Physician, Providence Regional Medical Center
Paul Edwards, '05 BS, '06 MS, '10 Ph.D., Materials Engineering Senior Manager, Tesla Motors
Boyd Fackler, '04 BS, '06 MS, '11 Ph.D., Lead Thermomechanical Engineer, Janicki Bioenergy
Ben Hempstead, '94 BS, Mechanical Engineer Lead and Chief of Staff, Electroimpact, Inc.
Megan Karalus, '07 BS, '09 MS, '13 Ph.D., Senior Application Engineer, CD-adapco
Rob Scheibe, '96 Ph.D., Principal, GT Engineering
Kat Steele, Assistant Professor, UW Mechanical Engineering
Angela Templin, '99 BS, Associate, Glumac
Mike Wilson, '77 BS, President, Wilson Property Services, Inc.