From the school head

As the new head of the School of MIME, I am excited to share with you the latest news through the fall issue of Forefront. It has been an action-packed 100 days since my arrival in Corvallis, and I look forward to continuing the growth and momentum of the school for years to come.

I've quickly come to know and deeply respect the work of our amazing faculty, the outstanding network of our industry partners, the inspirational ingenuity of our engineering students, and the commitment and support of our alumni. The following pages contain a sample of the innovation and excellence happening in MIME, with much more in store.

Please enjoy our stories, stay engaged, and share your stories with us. We hope to hear from you soon.

Warm regards,

Harriet B. Nembhard, PhD
School Head of Mechanical, Industrial and Manufacturing Engineering
Eric R. Smith Professor of Engineering

COVER
“Apex,” a wave energy converter mounted to the ocean floor designed and commercialized by MIME graduates.
(See story on page 3.)
Engineering classmates poised for commercial success

It might sound like an exaggeration to say that the concept breakthrough behind M3 Wave’s ocean power device and its subsequent commercialization are all based on a 1991 MIME senior engineering project. However, the founders of the wave energy converter technology company, Mike Morrow and Mike Delos-Reyes, stand by the legend. The long, complicated story of their senior project involves plastic spoons, breaking into a derelict wave tank in some old campus building for testing, and a few pieces repurposed from that iconic bit of 1980s technology, the Sony Walkman.

Morrow and Delos-Reyes have known each other since they were 4 years old. They grew up on the same street in Salem, Oregon, but attended different schools. Reunited at Oregon State as mechanical engineering students, they worked together on a few engineering competitions before ultimately partnering on their senior project. “We did not want to do one of the pre-canned projects, so we developed our own,” Morrow said. “That became the technology we are commercializing today.”

The project attracted some attention and won awards at various competitions, but it was forgotten for years after Morrow entered the career world and Delos-Reyes continued his studies. M3 Wave was founded in 2008 after the friends crossed paths again, this time as co-workers at the HP campus in Corvallis. Morrow said to Delos-Reyes one day in the hallway: “You know, these guys are still fooling around with surface buoys, and we came up with what we thought was a better technology almost 20 years ago. Let’s form a company, and see what we can do with it.”

M3 Wave’s Apex wave energy converter (WEC) is mounted to the ocean floor, rather than bobbing at the surface like the buoy-style WECs in development by the company’s competitors. With the Apex, there are no buoys or cables to interfere with fleet fishing, recreation, panoramic vistas, or sea creatures. And, according to the results of the company’s open-water testing, the Apex appears to be more durable, able to withstand longer deployments without equipment loss due to storms.

The U.S. Department of Energy Water Power Review Panel referred to the Apex as a “disruptive technology.” Morrow calls it a more socioeconomically sound and sustainable solution. “I did a study on how many units it would take to deliver half a gigawatt of capacity, and what real estate that array would require, and for us that was about one square mile,” Morrow said. “The competing technology, a buoy device, would take about 13 square miles.”

This year, M3 Wave was a finalist for the U.S. Wave Energy Prize, competing against eight other companies for the $1.5 million award from the Department of Energy. The competition is intended to drive the development of more capable WECs, ultimately reducing the cost of wave energy to make it more competitive with traditional energy solutions.

The company’s founders acknowledge there is still much research and development to go before households can start running their toasters with wave energy. “It depends on where you live,” Morrow said. “If you live in Oregon, it will be a while. Oregon has cheap power, and it may be that there are demonstration projects, but we still need a megawatt-class device.

Apex as a full-scale 150 kW device would be about 40 feet wide and 100 feet long, and it would deliver neighborhood-scale power. Or island-scale power. Or disaster-specific location power.

“Consider Fukushima – if we had something like that back then, we could have provided power to the backup pump, and they wouldn’t have had some of the issues they had with the backup power, and how things went,” Morrow said.

Mike Morrow (standing) and Mike Delos-Reyes (kneeling) work with crew aboard the “Ironworks”
As the new head of the School of Mechanical, Industrial and Manufacturing Engineering, Harriet Nembhard, Eric R. Smith Professor of Engineering, is off to a fast start in her first 100 days at Oregon State University.

“My initial assessment with everything I’ve observed and absorbed is that this school is ready to take off,” said Nembhard. “We have the pieces and the programs, the outstanding faculty, the impressive growth, and now it is time to take this momentum and truly elevate our achievements to the national and international stage.” Making that journey requires an expanded mindset, added Nembhard, who attributes the school’s strong position to nationally recognized programs, like Robotics, as well as the contributions of her predecessors.

“MIME faculty are already excellent collaborators. That’s one of our greatest strengths,” Nembhard said. “So my questions are: How do we impact one billion people? How will our innovations reach around the globe? How will our networks and partnerships grow?”

Nembhard, who comes from Penn State University, has had a noteworthy career as an academic leader and researcher. Her expertise includes health care systems engineering, operations research, process improvement, and quality control.

She cofounded and directed the Center for Integrated Healthcare Delivery Systems, which combined expertise from engineering, medicine, nursing, health policy, and information sciences and technology to develop holistic solutions to the challenges of health care delivery.

Nembhard also served as the interim department head of Penn State’s Harold and Inge Marcus Department of Industrial and Manufacturing Engineering, where she developed strategies for academic development and faculty recruiting, launched a new master’s degree program, and enrolled its first class.

At the school, Nembhard has already taken definitive action, funding the first round of the MIME Strategic Excellence Initiatives. Faculty will submit proposals that address focused areas of the school’s strategic plan each term. Nembhard has allotted $150,000 for the 2016-17 academic year — $50,000 for each term. By 2020, she aims to have $500,000 in annual funding for these faculty proposals.

For fall 2016, Nembhard and the associate school heads selected five $10,000 MIME Innovation Grants funding projects for innovation, instructional grants and research equipment, distinguished lecturer visits, and MIME faculty and instructor travel grants. Each term, the leadership team will review the next round of proposals that follow these initiatives.

Together with MIME faculty, Nembhard is focusing on the importance of curriculum development. She’s working to expand opportunities for undergraduate research, broaden multidisciplinary research with students and faculty from other engineering schools, and enhance student success through greater participation in student clubs and groups.

She also recently organized a MIME student club competition night, where eight club officers made pitches for their groups. The winner earned $1,000 for their club. Called a “PechaKucha Night,” the presentation format is limited to roughly seven minutes, giving students a small window to make their case and tout their clubs achievements. (Read more about PechaKucha Night on p. 5.)

“We know that students who are involved in these groups are successful at Oregon State. They work in teams and win competitions, and we see that they are quite successful when they leave to pursue careers,” said Nembhard. “We have a great opportunity to enhance their leadership and student learning experience. I think we’ll see more collaboration and participation across the groups as we continue to support them and their endeavors.”
Eight of the School of MIME’s student club leaders accepted the challenge from new school head Harriet Nembhard in early November to take part in the school’s first PechaKucha Night, a student organization showcase and competition, designed to develop the leadership and speaking skills of our engineering students. Nembhard offered generous prizes for the top presenters, sparking an enthusiastic turnout from the ranks of MIME student groups, faculty, and curious students, as well as a night of engaging stories about our student groups.

PechaKucha, the Japanese word for “chitchat,” is a creative presentation format in use across the world, first introduced by a group of architects in 2004. Slightly longer than the “elevator speech,” the PechaKucha presentation format offers a deceptively simple approach – allow a presenter to arrange photos or images onto 20 slides, and give them 20 seconds to talk about each slide. The slides advance automatically. The challenge, of course, becomes sharing the appropriate value of the picture’s 1,000 words before the slide changes.

Championing the six-minute, 40-second format was graduate student and NSF fellow Aaron Fillo, representing the new student club, Project X. Fillo’s passion for STEM and STEAM educational experiences for K-12 students inspired him to form the group last spring, and bring the Project X experience to students on campus as well as at science fairs across the country. His practiced-to-perfection demo included safety goggles, broken soda bottles, lessons on force and oobleck, and a wealth of data about how the hands-on science approach appeals to young women, potentially inspiring their future careers in STEM fields. As top presenter, Project X earned $1,000 for its future experiments and demonstrations. Project X’s faculty advisors are Bryony DuPont and Joshua Gess.

MIME Speaks Toastmasters, another recently founded student club that polishes the presentation and public speaking skills of its members following the methods of the Toastmasters International organization, earned a second-place finish and $500. Aaron Sprunger, industrial engineering graduate student, enacted the basic tenets of voice control, body language, and simplicity of message across a play screen of pop culture memes, and photos of legendary orators such as Martin Luther King Jr. Springer’s dynamic performance has already inspired a few curious PechaKucha participants to attend their 7 a.m. Tuesday weekly meetings, according to club co-advisor Ean Ng. Other faculty advisors are Javier Calvo-Am碘io and Gana Natarajan.

Such an outcome – increased collaboration by our students – is just one of the reasons Nembhard sponsored the event. She also hopes that our student clubs will work more closely together and share best practices on club management. “We have such an opportunity at this school to share in the excitement of student groups that are national and global champions, and build more teams of excellent engineering students working together and achieving incredible, positive results. These are the activities, experiences, and learned skills that are contributing to the success of our students when they leave us and enter the work force,” Nembhard said.

At the school level, Nembhard foresees a shared management model with streamlined budgeting processes, and the tracking of student success relative to their involvement in co-curricular learning experiences.

**Presenters**

Hunter Lottsfeldt, Blacksmithing Club

Aaron Fillo, Project X

Phil Thoma, Society of Automotive Engineers

Austin Sandifer, American Society of Mechanical Engineers

Nick McComb, OSU Robotics Club

Aaron Sprunger, MIME Speaks Toastmasters

Jeremy Melamed, Institute of Industrial & Systems Engineers

Karen Kuhlman, OSU American Institute of Aeronautics and Astronautics
The School of MIME won an unprecedented six awards — with accompanying funding totaling $29,250 — at the OSU University Day Faculty Senate Awards Night, an annual celebration that recognizes the year’s best achievements of all OSU faculty. The awards were handed out at a dinner ceremony by OSU President Ed Ray.

Christopher Hagen, assistant professor of energy systems engineering and director of the OSU Energy Systems Laboratory at the OSU Cascades Campus received two awards: the Faculty Innovator Award ($10,000), and the Excellence in Postdoctoral Mentoring Award ($2,000).

The Industry Partnering Award ($10,000), went to Karl Haapala, associate professor of industrial and manufacturing engineering.

Kendra Sharp, professor of mechanical engineering and the Richard and Gretchen Evans Professor in Humanitarian Engineering, was awarded the International Service Award ($1,000).

The Student Learning and Success Teamwork Award ($5,000) went to the Capstone Design Team of Javier Calvo-Amodio, Robin Feuerbacher, Chris Hoyle, John Parmigiani, Tracy Ann Robinson, and Nancy Squires.

Cindy Grimm, an associate professor of mechanical engineering, was awarded the Dar Reese Excellence in Advising Award ($1,000).

Award-winning faculty

MIME faculty take home six 2016 University Day awards

Kendra Sharp, professor of mechanical engineering and the Richard and Gretchen Evans Professor in Humanitarian Engineering, was awarded the International Service Award ($1,000).

The Student Learning and Success Teamwork Award ($5,000) went to the Capstone Design Team of Javier Calvo-Amodio, Robin Feuerbacher, Chris Hoyle, John Parmigiani, Tracy Ann Robinson, and Nancy Squires.

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Congratulations

Newly endowed faculty

MIME is proud to honor four additional faculty members with named positions.

Roberto Albertani
Boeing Professor of Mechanical Engineering

Jonathan Hurst
College of Engineering Dean’s Professor

David Blunck
Welty Faculty Fellow

Harriet Nembhard
Eric R. Smith Professor of Engineering

Promoted to professor

Sourabh Apte

Strategic Excellence Awards

The first MIME Strategic Excellence Awards were announced at the Nov. 4 faculty meeting. Congratulations to the following recipients:

MIME Innovation Grants
Ravi Balasubramanian and Burak Senser

MIME Instructional and Research Equipment Grants
Yiğit Mengüç
Bob Paasch
John Parmigiani and Brian Jensen
Somayeh Pasabani, Karl Haapala, Zhaoyan Fan, and Rajiv Malhotra

MIME Distinguished Lecturer Grants
Joshua Gess and Brian M. Fronk

MIME Faculty/Instructor Travel Grants
Brian Bay
Somayeh Pasebani
Gana Natarajan
Nancy Squires

College of Engineering Research Award
Kagan Tumer
The School of MIME faculty, staff, and graduate students came together for the annual welcome barbecue on Sept 15. The dinner closed a day of orientation activities for new graduate students and honored the graduate student standouts from the previous year. The following were recipients of awards:

**MIME Graduate Teaching Assistant of the Year Award**

Alexander Totpal earned this award for going out of his way to embrace ownership of the courses to which he was assigned.

**MIME Graduate Research Assistant of the Year Award**

Andrew Otto demonstrated outstanding leadership, mechanical, computational, and theoretical skills on Ross Hatton’s spider web project. Andrew’s work is the backbone of the project’s results to date, which are receiving significant attention from the public including a BBC feature article and a segment being filmed next month for a BBC nature show.

**College of Engineering 2016 Graduate Research Assistant Award**

Nitish Kumar won this year’s College of Engineering Graduate Research Assistant Award. Kumar, who earned his Ph.D. this fall, accepted a post doctoral research position in New Zealand.

**College of Engineering 2016 Graduate Teaching Assistant Award**

Katerina Morowsky won this year’s College of Engineering Graduate Teaching Assistant Award. Morowsky, who pursues a Ph.D. in industrial engineering, works as a GRA and a GTA. She was described by Ken Funk as the best student he’s ever hired in either category.
Assistant Professor Joshua Gess studies the fundamental science of heat transfer and thermal management systems. Combining his knowledge of heat transfer with novel experimental methods, such as two-phase cooling using dielectric coolant and high-speed image capture, Gess, a co-principal investigator at the Enhanced Heat Transfer Laboratory, seeks to develop methods that ensure reliable and efficient thermal management solutions for cooling high-performance electronics systems. The demand for ever smaller electronics technology has driven the need for more robust and effective cooling systems.

"Two-phase cooling is uniquely equipped to address that challenge," he said.

Gess joined Oregon State in 2015. After earning his B.E. in mechanical engineering from Vanderbilt University in 2005, he worked as a mechanical engineer at SSOE Group, which included an engineering consulting assignment for Johns Manville. He moved on to Northrop Grumman in 2008, where he worked on mobile communication equipment for the military. His next stop was Auburn University in 2012 to pursue advanced degrees. He received his M.S. in mechanical engineering in 2012 and his Ph.D. in mechanical engineering in 2015.

To illustrate the potential impact of his work, Gess points to the enormous energy consumption and resulting heat created by the world’s massive data centers that serve “cloud” computing.

"The amount of energy they use is astounding, and if we could make those systems just a little bit more efficient with better cooling systems, we could save an enormous amount of energy and put it back onto the grid,” he explained.

In one study, Gess is investigating the boiling heat transfer efficiency on the surface of electronics components that are immersed in nonconductive dielectric coolant fluid. The coolant removes heat from the surfaces as it boils. He likens the process to waves repeatedly washing onto a beach to cool the sand underneath — but which happens at 30 times per second. Using successive camera images, Gess is measuring how quickly the coolant moves back in to fill the void created by bubbles that form on the surface of electronic chips during the boiling process.

"We want a system that uses as little coolant or generates as little vapor as possible. Maximizing the convective heat transfer occurring during bubble formation versus the latent energy removed by vapor generation is the key to increasing the surface’s efficiency."

In other research, Gess visualizes how liquid coolant departs from the main flow to reach the surface of electronics components and determines the efficiency of that mechanism to quench the boiling process.

"Every bit of liquid that comes out of the flow to reach the surface of what it’s meant to cool needs energy to get there," he said. “We want to look at what kinds of surfaces optimize that process.”

He attributes his childhood interest in engineering to the movie Robocop and the TV series MacGyver.

"When I asked my grandfather how I could be like MacGyver, he said 'become an engineer,'" said Gess. He finds the reality of the work just as gratifying as he’d imagined. “It’s challenging from day to day, and I never know what new things will arise,” he said. "My students ask me questions about things I’ve never even thought about. Everything is so open ended, and I love that part of it."

Gess also relishes the moments of enlightenment when his graduate students “get it,” and watching them grow with each new accomplishment.

"The work is difficult, and I want to be there for them when they need me," he said. "The decision to get a Ph.D. shouldn’t be taken lightly, but once they’re here, we should provide all the support we can to help students succeed." To undergraduates, he emphasizes that their studies will have practical use on the job. "Sometimes students feel they’ll never use what they’re learning, but I’ve been out there and I assure them absolutely they will draw on many of the of the principles we deal with,” he said.

Among Gess’s longer-term goals is to establish a more robust support system for people with disabilities at Oregon State. “As a person with a disability, being able to return to school to get advanced degrees was a blessing, and I want to extend that blessing to others who may be intimidated by the thought of being on a big college campus where they worry about fitting in,” he said. “Let’s build an infrastructure so that anyone can come in and feel welcome.”

Gess is working with the School of Public Health to start an adaptive sports program. “I’d like to get to the point where OSU can accommodate anyone who wants to get an advanced degree. I think adaptive sports is an excellent place to start,” he said.
## Students by the numbers

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<tr>
<th>Program</th>
<th>Undergrads</th>
<th>Graduates</th>
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Total: 2,075

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Supporting MIME Excellence will help us continue to achieve great things

The School of MIME continues to rely on your support for our ongoing success. Please consider making a donation to support our student-centered priorities. For more information, please contact Harriet.Nembhard@oregonstate.edu, or make an online donation to the MIME Excellence Fund.