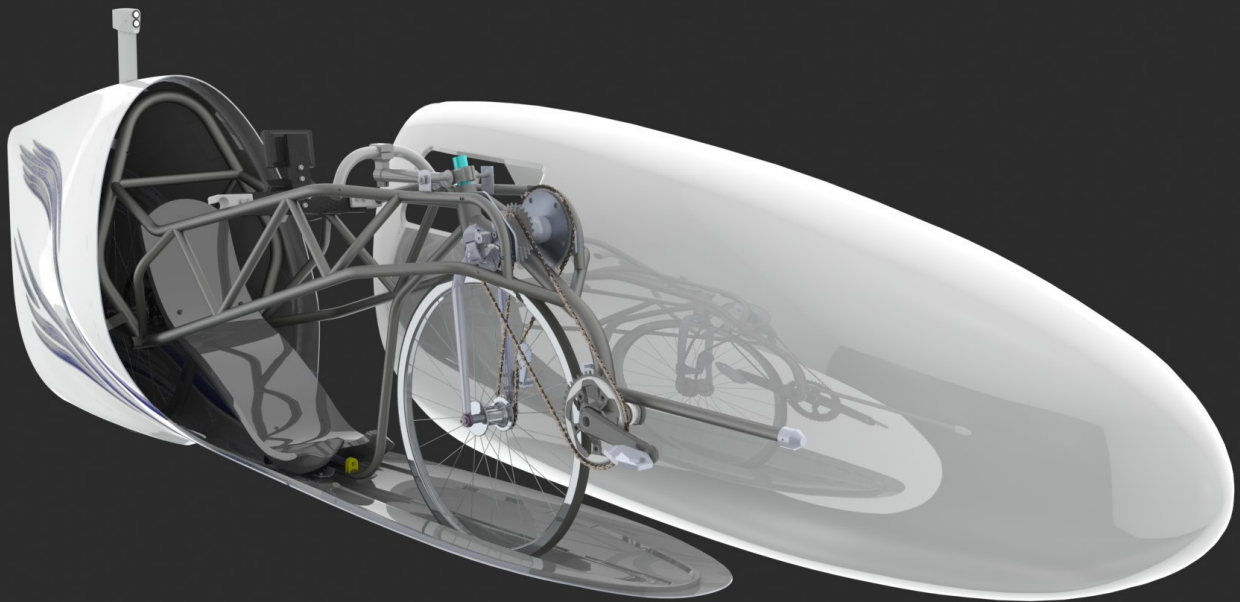


NEWS TO ME



Race to Battle Mountain

Human Powered Vehicle gears
up to set a new American
speed record



From the Department Chair

Now that the 2018-19 academic year has closed, it's a good time to reflect on the role of engineering in our society and how our mechanical engineering students are prepared to tackle societal problems. Cal Poly mechanical engineers show me every year that they are hard workers and amazing problem solvers.

To support our students, the department faculty continue to enhance our unique laboratory and experienced-based education, founded on the fundamentals and enhanced through hands-on problem solving. Our program gives students the tools to grow and adapt to society's ever-changing technological landscape.

In this issue of News to ME we are highlighting just a few of the amazing activities going on in the largest department in the College of Engineering. You will read about the Human Powered Vehicle club's efforts to set a collegiate speed record, how we are training future engineering educators (six of our spring graduates are entering doctoral programs across the country) and the humanitarian engineering work occurring in the QL+ club to name a few.

We are also growing and excited to welcome new faculty to the department. There is a hearty thank you to Dr. Jesse Maddren and Dr. Mason Medizade, who are entering our early retirement program, and a fond tribute to Professor Emeritus Jack Wilson who we recently lost. In the fall, we again look forward to welcoming a large and extremely academically gifted class of freshmen and transfer students.

As always, we appreciate the support of our industry partners and alumni who generously give to allow us to enhance the program and support Learn by Doing. If you are coming to San Luis Obispo, please let the Mechanical Engineering Department know, as I am always delighted and proud to show you around our ever-changing department. I hope you enjoy News to ME.

Sincerely,

Jim Widmann, Professor and Chair

SUMMER 2019

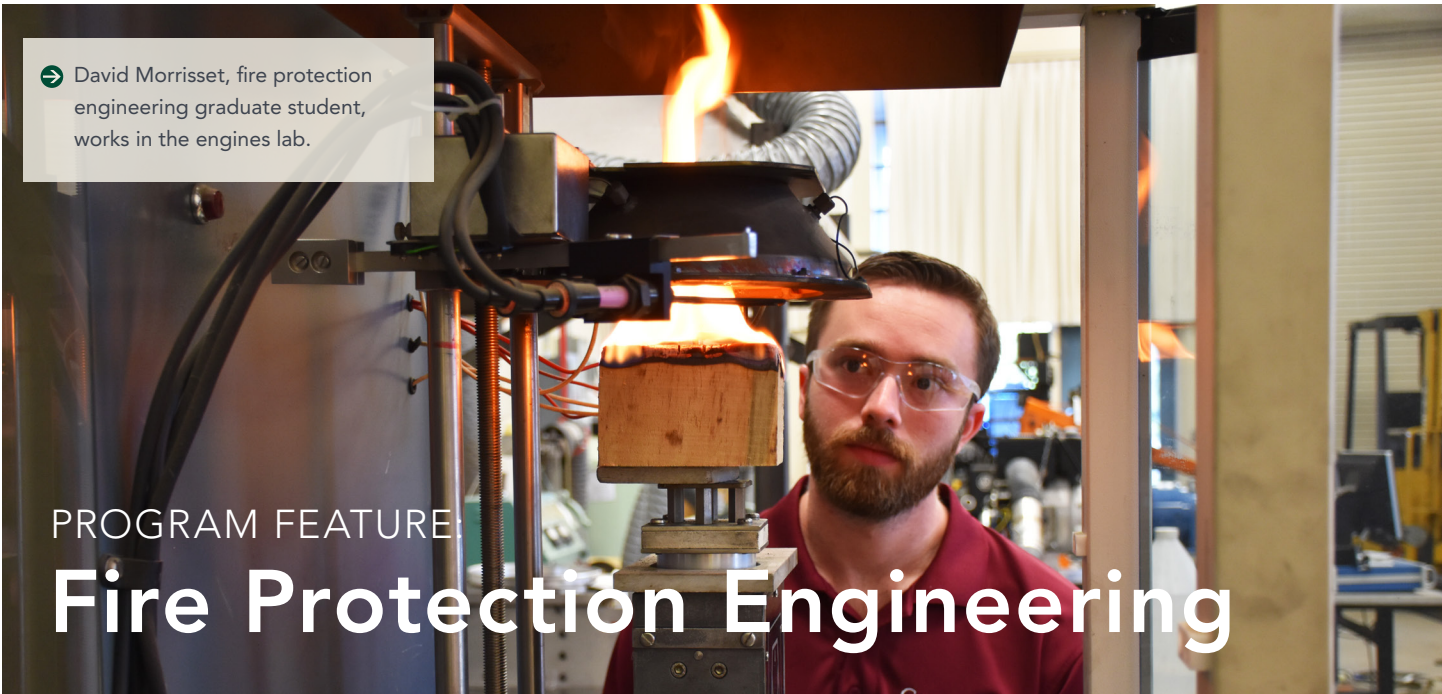
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Mechanical Engineering

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me.calpoly.edu



➔ David Morrisset, fire protection engineering graduate student, works in the engines lab.

PROGRAM FEATURE:

Fire Protection Engineering

Each year, more Californians are affected by the devastating effects of wildfires. Consider the reality: 10 of the top 20 most-destructive fires in the state have occurred in the past five years. The Cal Poly Fire Protection Engineering Master's Program is training students to prevent and combat these destructive hazards.

Cal Poly is only one of three schools in the nation offering this graduate degree — and is the only program of its kind on the West Coast. The program allows students to attend classes online and on their own time, which is helpful for working professionals. Since its launch in the fall of 2010, some 100 students have graduated.

Every design decision, whether for a building or a product, becomes critical when considering the hazards of wildland fires. These master's students are taught to consider how every design choice also can enhance fire survivability.

"Most people can go about their day without realizing how many fire hazards

are prevalent," said Richard Emberley, a fire protection engineering assistant professor. "And I think because of this, the common misconception about this field is that it doesn't exist."

Mechanical engineering students are well-trained to pursue this career path, Emberley said. At the core of fire protection engineering is material properties, fluid mechanics, thermodynamics and heat transfer that are all taught in the mechanical engineering core curriculum.

Fire protection engineering encompasses proactive spatial designs to protect occupants, the building and even the property. While many fire safety strategies used — alarm and detection, compartmentation, evacuation, suppression and structural integrity — apply to building safety, Emberley said they also can be applied to protect building occupants and the facility site as well.

Fire protection involves looking at a system holistically from the direct

hazards, to the community it affects and even the condition it's in, he said. Students learn to think about how even cultural norms within a community affect how people react in a fire.

A new concern for today's fire protection engineers includes hazards related to improved technology.

As companies and industry innovate, engineers must also develop new ways to protect products and the people who use them. And time has shown that there is no one-blanket solution for emerging technologies.

As a result, fire protection engineers must innovate with the times.

"Companies are continuing to optimize without thinking of the potential fire hazards. And because of this we are always trying to play catch up and are more years behind than we should be," said Emberley.

For more information about the Cal Poly Fire Protection Engineering Master's Program, visit fpe.calpoly.edu.



Sonya Dick, recent mechanical engineering graduate, did not always picture herself becoming a professor, but she discovered a passion while working with undergraduate students in the lab.

"I realized that the way I could have the greatest impact on people is by sharing my passion for engineering as a professor," said Dick.

According to the American Society of Engineering Education (ASEE), less than 16 percent of engineering faculty are women, and Dick is determined to change this. She explained that representation is important for students and notes that when they identify with their professors they may have a higher chance of pursuing a teaching career.

She was inspired to pursue a career in academia because of her research, lab experience and interactions through student teaching.

"My hope is that we continue to diversify our faculty. There is a lack of women in mechanical engineering and it's important that people see every type of person going into the field," Dick said.

She started out her teaching journey by guest lecturing physics classes at her hometown high school. Last year she started as an undergraduate research assistant under the guidance of Professor Brian Self.

In her research, Dick explores ways to incorporate the mechanical engineering biomechanics laboratory into dynamics courses at Cal Poly in ways that are engaging for both mechanical and non-mechanical engineering students. Currently, she is designing curriculum material for sophomore-level engineering dynamics classes using complex 3-D motion analysis technology to create 2-D problems.

"In order to create a problem for a sophomore-level dynamics class, it's important to first step back and think

about where they are coming from since you've already gone through the courses," Dick said.

She wants students to visualize and apply the fundamentals they learn in class using small scale models of real world problems in simple exercises like rolling a ball down an incline plane.

She shared that what makes a good teacher is their investment in the students.

"The people who take the extra step to keep the door open even when they don't have office hours show that they're here to educate and help the students," said Dick.

Dick recently won the ASEE Pacific Southwest Section Undergraduate student Award for her work as an undergraduate research assistant student and was also given the College of Engineering Academic Excellence award for maintaining a perfect 4.0 GPA.

She will begin her doctorate program in mechanical engineering this fall at the University of Michigan.

"He was my department head, my colleague, my role model and my friend. "

— Saeed Niku, mechanical engineering professor

Remembering Professor Jack Wilson

Professor Emeritus Jack Wilson passed away on May 1, 2019. If you were a mechanical engineering student between 1985 and 2001, you likely had him for one of the many courses he taught, mostly in the thermal sciences area. If you did, you'd remember him as one of the most generous and kindest people you ever met. We agree.

Wilson grew up on a dairy farm in Michigan and served in the U.S. Army before studying agricultural engineering at Michigan State University (MSU). He worked as a design and experimental engineer at the Oliver Corp. in South Bend, Indiana, before returning to MSU for graduate school. He taught at the University of Georgia before coming to Cal Poly in 1976.

Wilson was originally hired as the head of the Agricultural Engineering Department. In 1985, he joined the Mechanical Engineering Department as head.

According to Ray Gordon, professor emeritus, "I was just finishing up my term as department head, and we approached Jack to replace me. Jack said he'd do it for one year as long as he could stay in mechanical engineering as a faculty member." And stay he did — for the next 16 years.

"Jack was a magnificent teacher," said Gordon. A natural leader, he also served as chair of the Cal Poly Academic Senate



in the early 1990s.

Professor Jim Widmann, mechanical engineering chair, remembers Wilson as being very soft spoken, generous and always willing to listen, "We shared a common origin from Michigan, which we liked to chat about. He had good common sense Midwestern values and attitudes. I definitely liked talking to him."

Saeed Niku, a mechanical engineering professor, agreed. "I remember him as a kind, fun, classy gentleman," he said. "He was one of the first faculty to bring a big stereo to his office to play classical music. He was my department head, my colleague, my role model and my friend."

Melinda Keller, a mechanical engineering lecturer, said, "Dr. Wilson was my ME 236 professor and later my senior project advisor. He helped me succeed with my project, even though it was not his area of expertise." Keller, who earned a bachelor's and master's in mechanical engineering from Cal Poly, added, "He let me know it was OK not to know things, and that good problem solving skills and project management were more important than knowing the solutions ahead of time."

"He taught me how to cut scope and focus, how to ask questions and lead

someone to answers — even when you don't know those answers yourself! He was excited to learn alongside me and to provide insight when he could. He had so much experience in so many things that he patiently used to help his students along their paths."

Professor Jim LoCascio remembers Wilson as a wonderful human being with a smile that would brighten anyone's day. "He served as our department chair and had the best interest of the students, faculty and department in all the decisions he made," he said.

"I will always remember the stories that Jack told about growing up on a farm in Michigan during the Depression," recalls LoCascio. "I especially remember him talking about using newspaper in the family home for insulation. How he and his siblings would share a bed to stay warm in the winter. I really enjoyed watching his loving smile when he would explain that his wife, Joanne, had a lead foot when she got behind the wheel. The Wilsons would bring their disabled daughter to Mechanical Engineering Department functions, and you could see the loving care they gave their child."

We'll miss you, Jack.



➔ Ryan Kissinger, co-lead of Hands for Julian, fits the prosthetic prototype on Julian Reynoso.

While the wounds on 10-year-old Julian Reynoso's hands are healing from a deadly drunken driving accident, a team of engineering students worked to improve the quality of his life by creating a pair of prosthetic hands that will help him be a kid again.

"He couldn't play with Legos, he couldn't do all the simple things that I enjoyed in my childhood," said Ryan Kissinger, co-lead of the Hands for Julian team. "So the scope of the project is restoring that for him."

In April of 2018, Reynoso was traveling with his family in their minivan through a Los Angeles intersection when a suspected drunken driver ran a red light and plowed into their vehicle, which was dragged 25 feet before catching fire. Bystanders frantically worked to pull Reynoso and his mother from the flames, but they could not save his father and two siblings. Reynoso sustained burns on 85 percent of his body and he lost all or parts of nine fingers.

Five months later, Kissinger, a mechanical

engineering student, learned of the boy's needs through the Quality of Life Plus (QL+) club on campus, which pairs people who have physical challenges to students, who work to improve the quality of life for the "challenger." After accepting the challenge, Kissinger formed an eight-student team from the mechanical, biomedical and electrical engineering programs.

Austin Conrad, another mechanical engineering student, was one of 70 who applied, knowing the project would be demanding, since the accident had occurred just a few months earlier.

After meeting Reynoso at the QL+ lab, the students learned that he would need two very different prosthetics, matching the level of disability for each hand. His right hand has enough digits to manually control the action of three fingers and a thumb on a mechanical hand, but his left hand was more severely injured.

As a result, the team began developing a bionic hand, with motorized fingers, which are activated by the nub of his left hand. To help fund the project, Kissinger

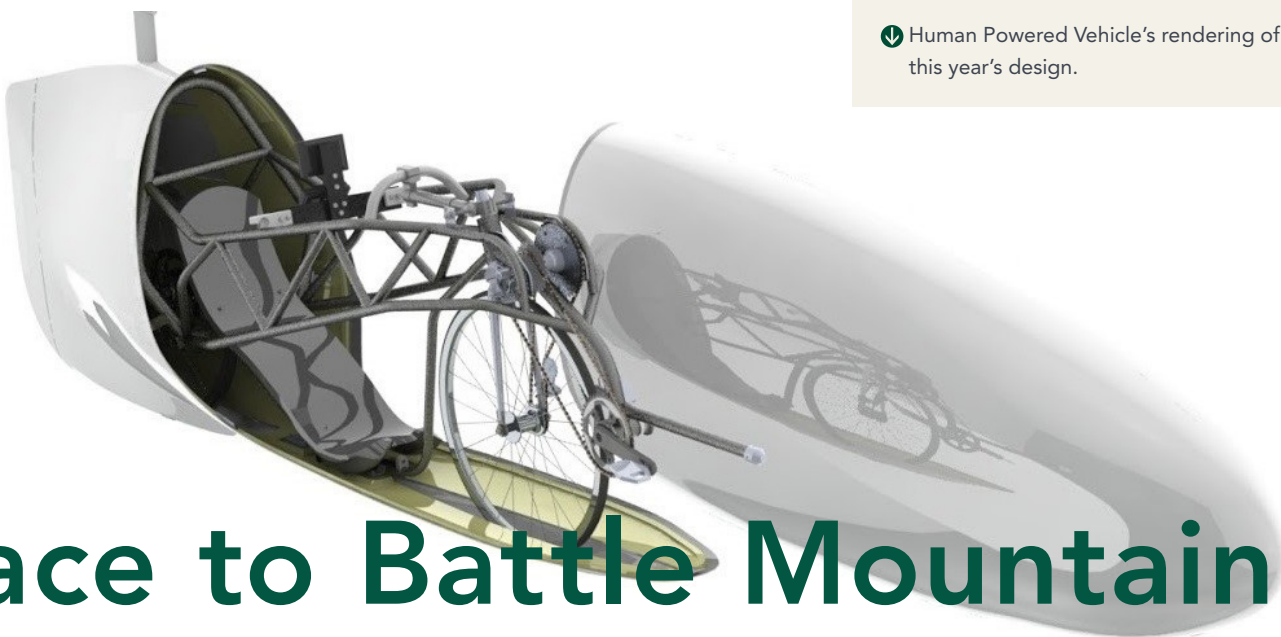
started a GoFundMe campaign, which reached its \$5,000 goal within 48 hours. But after they created molds of Reynoso's hands, created computer models and began working on prototypes, they discovered a new challenge.

"The accident was so recent, the scar tissue changed — the swelling changed," Conrad said. "And to top it all off, aside from the injuries changing because it's so recent, he's 10 — so he's growing."

As a result, the team had to constantly modify the prosthetics design. At the same time, they had to complete the project by the end of the school year so they could present Reynoso his hands at Cal Poly on June 8.

Reynoso's emotional scars will likely take even longer to heal, but Kissinger said he was impressed with his attitude and the final outcome.

"He's very charismatic," Kissinger said. "Maybe it's some testament to the human spirit about people's ability to press on in spite of tragedy. When he was here, he was playing on his Nintendo Switch, and he was cracking jokes."



↓ Human Powered Vehicle's rendering of this year's design.

Race to Battle Mountain

In just a few months, Cal Poly Human Powered Vehicle (HPV) will be compete against top-ranked international teams to beat a national record at Battle Mountain, Nevada, which is famous (in a small way) for hosting the annual Fastest Human-Powered Speed Challenge — the most prestigious event in the world of speed bicycling.

The team's goal is to eclipse the American collegiate team speed record — held by UC Berkeley — of 61.3 mph and the current Cal Poly record of 58.9 mph.

The team is competing at Battle Mountain for the first time, although Cal Poly students have been racing high-performance bicycles since 1978. This competition is purely about speed, said Max Chinowsky, the team's vision and social media lead.

"There were so many factors that we had to account for in previous competitions that we couldn't excel at any one thing," said Chinowsky.

This year's recumbent design features two wheels, a slim frame built specifically for

the driver, smaller clearances, lightweight frame, minimized frontal area and an increased focus on reducing all sources of chain rub.

"Any little thing affects performance. We designed it perfectly enough so that the driver is comfortable enough to peddle with full power," Chinowsky said.

Over the 2018-19 academic year, the team has focused their efforts to research, design and build the bike. The team includes more than 30 students with a core group of 15, a chief engineer and a project manager. To achieve their goal, the team reorganized and formed specialized teams working on lead, fairing and drive train systems. Chinowsky explained that a big part of making sure this project is successful is management.

"None of the parts are complicated to build in and of themselves, but it's getting them to work together efficiently that is most difficult," he said.

During fall quarter, the team finished the design in SolidWorks, a 3-D computer-


aided design and engineering software program. They did finite element analysis to ensure the frame was safe and passed all its loading requirements and computational fluid dynamics on the fairing to make sure it had maximum laminar flow. The bike was designed to fit the rider perfectly to maximize performance and reach their speed goal.

They used SolidWorks to verify clearances and sizing and created a comprehensive model of their rider. During winter quarter, they began manufacturing molds for the fairing and spent long hours laying up the fairing and welding frame tubes. The team has been assembling the bicycle since the beginning of spring quarter and will continue to modify and perfect the bicycle through the end of summer.

The team will compete Sept. 8-14, 2019 at Battle Mountain.

Support

For more information about the Human Powered Vehicle and to support the team, visit their website at www.hpv.calpoly.edu.


 A photograph of Jesse Maddren, a bald man with a friendly expression, wearing a plaid shirt. He is standing in a laboratory filled with HVAC equipment, including pipes, valves, and a large black mesh enclosure. The text "HVAC&R Legacy" is overlaid in large white letters across the bottom of the photo.

↓ Jesse Maddren in the HVAC&R lab.

HVAC&R Legacy

After 20 years, Jesse Maddren, a distinguished mechanical engineering professor, will retire in August. He joined the department in 1999 and was instrumental in developing the Heating, Ventilation, Air Conditioning and Refrigeration program into what it is today.

Because of budget cuts and lack of engagement, the program had declined before Maddren's arrival at Cal Poly. He recognized the importance of HVAC&R and the HVAC&R program and the rich history it had and set out to rebuild it.

He invited about 15 HVAC&R industry professionals, mostly Cal Poly alumni, to Cal Poly and sought their help to reinvigorate the program. This group would become the founding members of the HVAC&R Industrial Advisory Board. They agreed that the program was vital to mechanical engineering students and the industry in California, and they were committed to rebuilding and creating opportunities for graduates. Maddren pointed out that this group was a large part of the success of the program.

"The industry people I work with are dedicated to what they do and being able to build the HVAC&R program with them has been very rewarding," said Maddren.

Maddren helped develop an HVAC&R curriculum concentration in 2005. The purpose was to expand the curriculum and prepare students for careers in the industry.

To ensure the success of the program in perpetuity, the advisory board helped build an endowment to support the program. In 2007, the group launched a fundraising campaign with matching funds from Bay Area SMACNA (Sheet Metal and Air Conditioning Contractors' National Association) and raised \$700,000 over a two and a half year period. Under the direction of Maddren and with the support of industry and alumni, the endowment has since grown to \$2.5 million.

Maddren's next goal was to renovate the HVAC&R lab. With the help of a \$250,000 cash donation from Critchfield Mechanical Inc. and donations of equipment and services from several

other companies, the HVAC&R lab was completed in 2011. The goal of the lab was to inject learn-by-doing into the curriculum and expose students to industry grade equipment.

"I always valued working in the lab," Maddren said. "I wanted to create a working lab where students could get practical experience working on equipment that they would use in the field."

The HVAC&R program hosts an annual golf tournament and various weekend events to help raise money for the endowment. To date the annual event has raised more than \$500,000 for the endowment.

Maddren shared that the main reason for his work in the program is the students.

"The best part about my job is working with students. Being able to help people learn something new is rewarding," he said.

Support

To learn more about how you can support the HVAC&R program, visit our website at www.me.calpoly.edu/hvacr-iab.

Bently Nevada Supports Learn by Doing

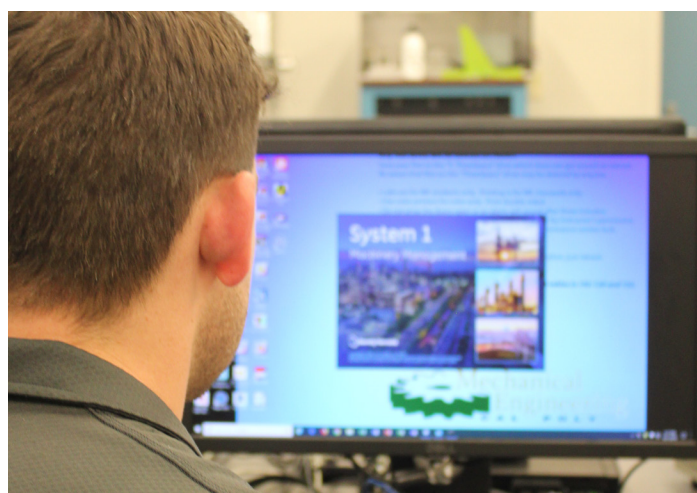
For more than 20 years, Bently Nevada has been a supporter of the Mechanical Engineering Department and co-sponsor of the vibrations and rotor dynamics lab. Their support ensures that students get hands-on experience using the latest industry technology and are Day One ready. This year, Bently Nevada donated System 1 to the vibrations and rotor dynamics lab to support student learning in rotor dynamics.

“Supporting the next generation of engineers is close to our hearts, and rotor dynamics is an area of study pioneered by our founder, Don Bently,” explains Hannah Pence, Global Communications Leader for Bently Nevada at BHGE.

System 1 is Bently Nevada’s flagship software platform that offers a modern and intuitive interface that enables users to manage monitoring programs. The system was introduced in 2001 and has become the industry standard for rotating machinery, vibrations monitoring and diagnostics.

Students will use System 1 in conjunction with rotor kits also donated by Bently Nevada. Undergraduate students in ME 318 will use the software in labs to help correct any unbalance in the rotors as they spin. Graduate students in ME 518 use the rotor kits more extensively and perform multiplane balancing and model rotating machinery phenomena such as anisotropic bearing stiffness and fluid induced instabilities caused by fluid film bearings.

Vibrations in these kits are measured using proximity sensors located along the shaft. Once System 1 is fully installed, the Bently Nevada 2300/20 vibration monitor will read the proximity sensor signals and upload it to System 1. Since the 2300/20 monitor only has two input channels, the system will be used primarily for undergraduate classes.



News & Awards

DEPARTMENTAL NEWS

Cal Poly's Mechanical Engineering program has been named the No. 2 undergraduate program in the nation by *U.S. News & World Report*.

RESEARCH NEWS

- Assistant Professor Hans Mayer and a mechanical engineering student team are collaborating with Lawrence Livermore National Laboratory researchers to improve the safety of Department of Energy (DOE) nuclear facilities during fire scenarios. The team designed, built and tested a prototype device used to create novel MTC HEPA filtration media. Initial testing demonstrated that the prototype can reduce a processing step by 10 times and eliminate this step from being the process bottleneck. The project is funded by the DOE's Nuclear Safety Research and Development Program.
- Daimler Trucks North America

↓ Professor Charles Birdsong



➔ Newly-hired Assistant Professors Dr. Jennifer Mott Peuker and Dr. Hans Mayer.

has supported work with Professor Charles Birdsong in developing a small scale tractor-trailer autonomous vehicle. This work was conducted through two senior project teams; the first developed the chassis and the second developed the electronics and software. Two identical vehicles will be manufactured; one delivered to Daimler in Portland, Oregon and the other will stay at Cal Poly and serve as a platform for future research in vehicle control and automation. In addition Daimler has given financial support for a team of mechanical engineering and computer engineering students to travel to the ESV International Student Design Competition in the Netherlands in June 2019 where they showed off a demonstration of autonomous vehicle platooning that was developed in an interdisciplinary senior project. See photo on page 11.

- Assistant Professor Ben Lutz and Professor Brian Self are using active learning and hybrid course modules to promote identity, belongingness and sense of community in mechanics courses

and to mitigate equity gaps (i.e., differences in performance, GPA) for underrepresented students in engineering and science courses. The professors are developing studio-modeled courses with flipped classroom structures and learning assistants in physics, statics and dynamics sections — classes that most STEM majors must take and that represent a significant bottleneck in the curriculum.

- Assistant Professor Lutz is exploring the impact of engineering teams' gender proportion on creative capacity and ideation effectiveness.

FACULTY HIRES

- Dr. Jennifer Mott Peuker was hired as an assistant professor
- Dr. Hans Mayer was hired as an assistant professor

STUDENT AWARDS

College of Engineering Academic Excellence

- Sonya Christine Dick (See profile on page 4.)

College of Engineering

Undergraduate Academic Excellence

- Sonya Christine Dick
- Joshua Bryan Wyman Clemons

College of Engineering

Graduate Academic Excellence

- Bradley Wash
- Trent Peterson
- Brock Johnson
- Gregory Pellegrino
- Jordan Nedbailo
- Thomas Goehring
- Kevin Gasik
- Alex Schnorr
- Nathan Hoyt
- Margaret Juran
- Anthony Jungquist

Mechanical Engineering Department Outstanding Service and Leadership to Their Club

- Michael Juri (HPV)
- Kyra Schmidt (HPV)
- Derrick Fromm (HPV)
- Parker Reynolds (Supermileage)
- Eric Zhong (ASME)
- Paul Swartz (SAE)
- James Schubert (ASHRAE)
- Greg Ritter (Bike Builders)

Outstanding Service to the Mechanical Engineering Department

- Lisa Kusakare
- Kate Goldsworthy

MESFAC Award recognizes students who served on the committee for their service

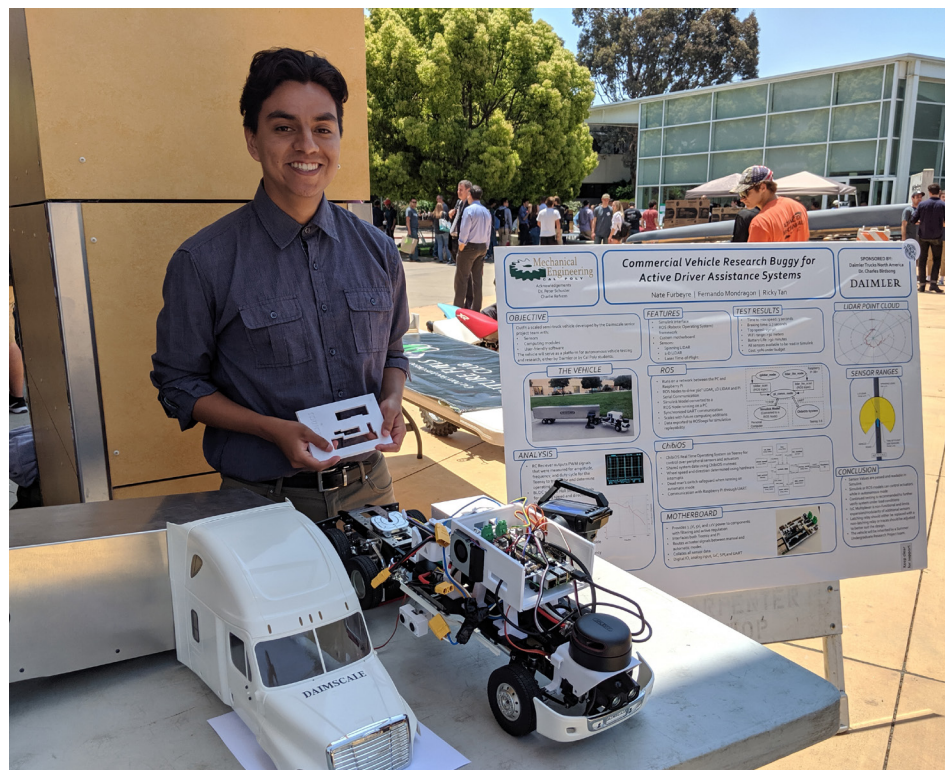
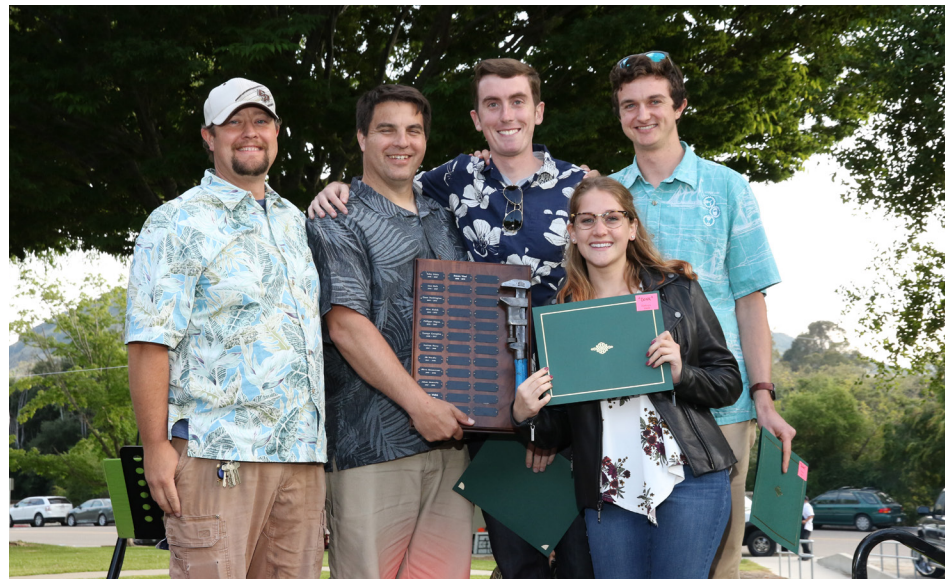
- Jessalyn Bernick

- Chris Ferdor
- KC Egger
- Lynette Cox
- Donovan Zusalim

DONK Award recognizes graduating machine shop technicians who have gone “above and beyond” in their role.

- Chris Scarborough
- Kathryn Webb
- Steven Waal

📌 “DONK” Award recipients at the annual senior party with machine shop supervisors Eric Pulse and Jim Cullins.



➡ Fernando Mondragon-Cardenas and his senior project team developed a small scale tractor-trailer autonomous vehicle under the guidance of Professor Charles Birdsong.

CAL POLY

Mechanical Engineering

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San Luis Obispo, CA 93407



← The ASHRAE Region X Southern California Chapter awarded six mechanical engineering students \$13,000 in scholarships at their monthly meeting on May 7, 2019. The amounts ranged from \$1,000 to \$5,000.

From left: Madeline Faase, Jerry Wakai, Phil Trafton (Scholarships), Huizi Guo (Student Activities), Ricson Chude (Southern California ASHRAE President), Taylor Harms, Michael Hanson. Not pictured: Ryan Sparks, Weston Cruz Montgomery