



University of Idaho
College of Engineering

MECHANICAL ENGINEERING NEWS

NEW ENDOWED PROFESSORSHIP

Strengthening Research

*Professor Eric Wolbrecht named
Dean and Cindy Haagenson
Mechanical Engineering Endowed
Professor*

Written by Eric Wolbrecht

This summer, I was honored to be appointed as the first Dean and Cindy Haagenson Mechanical Engineering Endowed Professor. This distinguished faculty recognition is the highlight of my career at the University of Idaho and I am grateful to the Mechanical Engineering Department, the College of Engineering, and most importantly Dean and Cindy Haagenson for their generous gift. Dean (B.S.M.E. '65) and Cindy (B.S.Ed. '72, M.S.Ed. '82 in special education, M.S.Ed. '87



Eric Wolbrecht

in counseling and human services) Haagenson are proud Vandals who have an extraordinary record of philanthropy.

Over the years they have generously given of their time, talent, and



Dr. Joel Perry, Endowed Professor Dr. Eric Wolbrecht, Ph.D. student Christopher Bitikofer, Ph.D. Sebastian Ruda Para, Cindy Haagenson, and Dean Haagenson in the rehabilitation robotics lab.

resources to support the University of Idaho and numerous Idaho charities.

The Endowed Professorship is Dean and Cindy's latest gift to the Mechanical Engineering Department. The impact of this gift goes well beyond my own research and will have a transformational impact on the Mechanical Engineering Department for years to come. The purpose of an

endowed professorship is to support the research program of the appointed faculty.

Research is a critical component of the mission of the Mechanical Engineering Department and the University of Idaho. A strong research program produces new knowledge and technology for the benefit of society. Faculty engaged in research stay up to date on modern engineering

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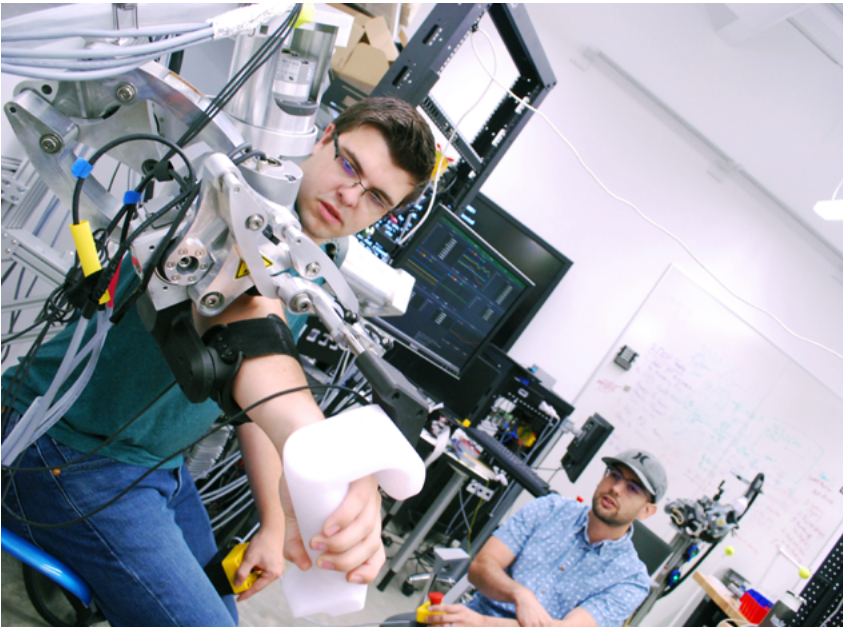
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(Above) Graduate students Chris Bitikofer (left) and Rene Maura (right) test the a dual-arm exoskeleton BLUE SABINO, designed to evaluate neurological impairment after stroke and gather quantitative data to refine therapeutic medicine and improve treatment.

(Right) Graduate students Vishwanath (right) and Sebastian Rueda Parra test the thumb and finger grasping exoskeleton named FINGER 2.0.



theory and practice, enriching the curriculum of the department. Students participating in research, both graduate and undergraduate, gain valuable experience and expertise that empowers them in their future careers in industry, as entrepreneurs, and as future researchers.

My own research uses robotics and related technologies to help people who have suffered a neurological injury (primarily stroke). In the Assistive Robotics Laboratory, co-directed with Dr. Joel Perry, current projects include a dual-arm exoskeleton (named BLUE SABINO) funded by the National Science Foundation, and a thumb and finger grasping exoskeleton (named FINGER 2.0) funded by the National Institutes of Health. Both devices are designed to administer physical rehabilitation and assess impairment and function. They are also uniquely capable scientific instruments for evaluating the efficacy of different approaches to therapy and investigating factors that correlate with recovery. Research programs are only as strong as their graduate students.

This endowment creates a stable source of funding that will enable us to recruit top talent, maintain research projects at the highest level, and secure additional funding from external sources, a clear multiplier effect. This investment is truly transformational, as it ensures continued

progress and the ability to produce meaningful, high impact results that advance engineering research and practice. Supporting synergistic undergraduate research and team projects is another way endowments invest in the long-term success of a research program.

As a start, this year I've committed endowment funds to two Senior Capstone design projects that involve robotics and/or assistive devices. Dr. Perry and I are also planning to form a student-led undergraduate robotics team working on multi-semester projects and disseminating their findings in appropriate venues such as academic and student conferences.

These Capstone projects and undergraduate teams elevate the skills and abilities of our undergraduates, helping them to compete and excel as employees, entrepreneurs, and graduate students in the future.

Fully honoring Dean and Cindy's gift requires careful stewardship of the financial resources afforded by the Endowed Professorship. Among other things, this means working closely with the ME Department chair and other faculty researchers to identify common research needs. Combining the endowment funds with other sources can facilitate larger equipment purchases and other research

expenditures. Leveraging the funds in this way broadens the impact of the endowment on research activities and student researchers within the Mechanical Engineering department. I would not have received this prestigious appointment without help. Throughout my career I have been blessed by the support of many amazingly talented and generous people.

In my research, I've been lucky to collaborate with brilliant people both here at UI and across the country who helped me make the most out of my talents. In the Mechanical Engineering department, I've been fortunate to be surrounded and supported by faculty and staff who share my passion for education and research and want to see me succeed as a teacher and scholar. And at home, I've had endless encouragement, consistent support, and plenty of rejuvenating joy and laughter.

Receiving this appointment reminds me that I am forever grateful to all who have supported my work. I'm excited about the incredible impact The Dean and Cindy Haagenson Mechanical Engineering Endowed Professorship will have on my career and the Mechanical Engineering department.

Please join me in thanking Dean and Cindy!

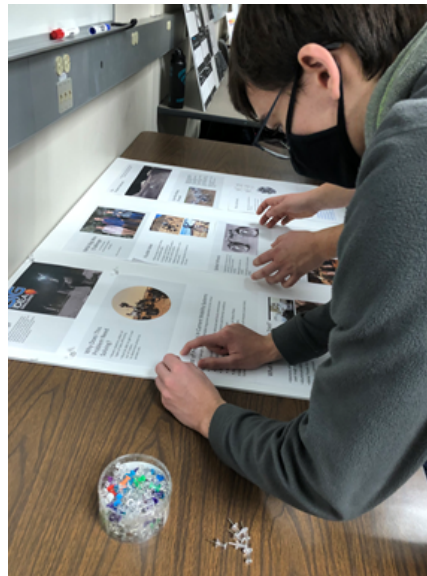
Go Vandals!

Improving the First-Year Experience

Written by Steve Beyerlein

During the Fall 2021 semester, Steve Beyerlein and Associate Dean Patricia Colberg piloted the new 2-credit First Year Engineering (FYE) course that was profiled in the spring newsletter. The course features hybrid development on technical skills needed in early STEM courses and professional skills needed for academic as well as career success.

During the second half of the semester these are integrated in learning activities that feature project work and preparation for workplace experience. Project work has engaged sponsors and clients from various campus/community entities (U of I facilities, U of I Sustainability Center, NASA Space Grant Consortium, and the Palouse Basin Aquifer Commission). Teams of 3-6 students were assigned to these projects based on a bid portfolio. In late-October they did a problem definition Snapshot in the Design Suite that attracted a variety of outside guests (sponsors, graduate students, and faculty/staff) who provided feedback on project scope, project learning activities, and project management. The flavor of the event was similar to the first Capstone Snapshot Day. Results of project work will be shared in technical presentations as well as design reports during the final week of the semester. Parallel to the team project, students identified a career pathway or specialized



Students participated in a problem definition Snapshot that attracted a variety of outside guests.

role of interest and were matched with U of I alumni who matched these profiles. A variety of lively informational interviews resulted; and students will be sharing their discoveries with classmates during the week before Thanksgiving break. Students will also use insights gained from the interviews along with lessons learned via guest speakers on student clubs, networking, career fair preparation, internet searching, and resume construction in

developing a professional growth portfolio. The portfolio includes a one page narrative on (i) long-term goals/vision for all aspects of one's life, (ii) an analysis of the day in the life of someone in a career pathway/ specialized role of current interest, (iii) a self-assessment of their current NACE (National Association of Colleges and Employers) competencies, and (iv) an action plan for next semester based on first-hand experiences, knowledge gained, skills developed, and lessons learned during their first semester on campus.

The pilot section has 32 students whose current majors are approximately 1/3 mechanical engineering, 1/3 undeclared engineering, 1/6 civil & environmental engineering, and 1/6 chemical and electrical engineering. In a mid-semester survey, students reported that the class environment was always welcoming, the course was more engaging as well as more challenging than they imagined, they greatly enjoyed our selection of interactive guest speakers, and they valued the opportunity to work together with peers and clients on mini-projects that had long-term campus significance. The ME department has adopted the new FYE course which will be taught to interdisciplinary student sections in Fall 2022. Dan Cordon will be on the instructional team and he is looking forward to exploring opportunities of the new format with next generation Vandal Engineers.

Manufacturing experiences in the classroom

Written by Michael Maughan and Eric Wolbrecht

Lean manufacturing was back in-person for 2021! The in-person course offered a rich experience that leveraged materials developed during 2020 for virtual delivery. While still taking precautions to prevent the spread of COVID-19, students in the course formed teams to make block projects and get some machine shop experience. For the second year in a row the class conducted virtual factory simulations to manufacture "Vandal" cars using

WATCH THE VIDEO

Walk through the Machine shop and learn about basic safety practices.

bit.ly/ME-machine-shop-safety

lean manufacturing principles. We didn't quite get to zero defect rate – maybe next year!

Tours of local industrial facilities

have always been a highlight of our Lean Manufacturing course. This year COVID-19 again prevented in-person tours, but thankfully CCI/Speer of Lewiston and Schweitzer of Pullman were able to bring the tours to us! A big thank you goes to Jonathan Richards of Schweitzer and to Jeff Williams, Nic Penzer, and Dave Neely of CCI/Speer for coming to UI and presenting their factories and Lean Manufacturing experiences with the class. Their efforts made a huge impact on the students in the course.

There were also nine Kaizen (continuous improvement) projects conducted by teams of 2-3. We had some great improvements to our ME facilities, such as a new machine shop safety video. A dedicated team also prototyped a device to be used in a new project for our sophomore ME 223 Mechanical Design Course. This tensile tester proof of concept was capable of measuring breaking loads for copper wires and is being used as a tool for teaching Arduino/mechatronics in ME 223 this Fall 2021 semester.

Capstone Tackles Impactful Project List

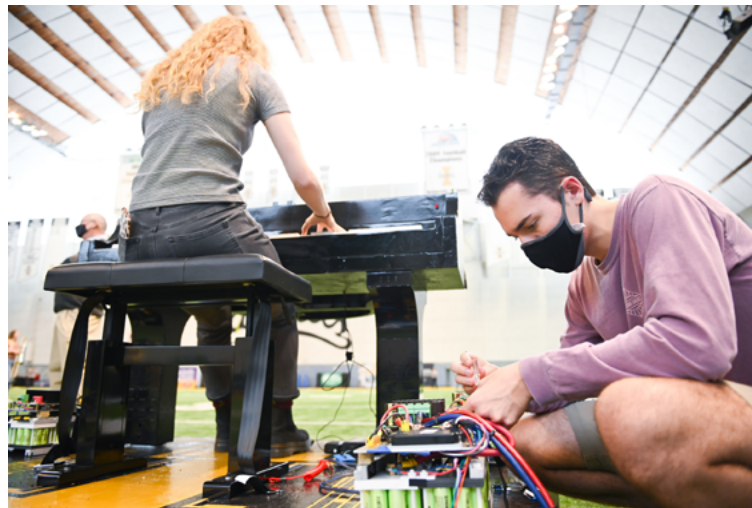
Written by Matthew Swenson

One of the most gratifying aspects of being involved with Capstone Design is the annual opportunity to watch our talented interdisciplinary engineering students engage in a large variety of projects. It is so wonderful to see the new challenges that our students are excited to take on each year, and the energy that surrounds the beginning phases of these projects.

This year, I believe we have one of the most impactful project lists that I have seen in the past 5 years, continuing the strong tradition of interdisciplinary collaboration that our program is known for. Many of the projects this year have common interests and themes, with objectives that address real societal challenges.

Three different projects are focused on various initiatives surrounding forest fire research. Several more projects are targeted at development of robotic capabilities, and three separate interdisciplinary teams are working on development of novel self-propelled electric vehicles.

At the same time, we have multiple teams engaged in development of unique ergonomic solutions for various applications, and we have



In a project completed fall 2021, mechanical and electrical engineering seniors put the finishing touches on a collaborative effort to bring an electrically-driven, remote-controlled stage to Vandal Marching Band halftime shows.

three separate teams developing new equipment for conducting state-of-the-art materials research.

Finally, one project of note is a new product innovation directly resulting from a collaboration between the University of Idaho and a 7th grade participant in Invent Idaho program. With such variety and opportunity for our engineering students, it is hard to not be optimistic about our Capstone Design program. We are particularly grateful to the many industry sponsors that provide generous funding, time, and encouragement to our students each year.

2021-2022 SPONSORS

- Advanced Input Systems
- Bastian Solutions
- Forest Concepts
- Hyster-Yale Material Handling
- Idaho National Laboratory
- NASA
- Nightforce Optics
- Schweitzer Engineering Laboratories
- Stanley Solutions
- TrellX

INFRASTRUCTURE IMPROVEMENTS

Engineering Summer: Two Decades of Vandal Innovation

Written by Alexiss Turner

For 21 years, Vandal engineers have competed in the Society of Automotive Engineers (SAE) Clean Snowmobile Challenge. Our Clean Snowmobile Challenge (CSC) Team has collected more than 50 competition awards in that time. Two decades of Vandal innovation has generated

a lot of spare parts and retired machines! Mechanical engineering sophomore McKenzie Reid is an intern with the National Institute for Advanced Transportation Technology (NIATT), breaking down machine equipment and sorting it into recyclable parts. Reid said the experience has sharpened her project management

skills and piqued continued interest in how mechanical devices work. This fall, Reid is continuing research on the CSC team's continuously variable transmission (CVT) test bench, designing a device to collect efficiency data on the automatic transmission system that can continuously change gear ratio.

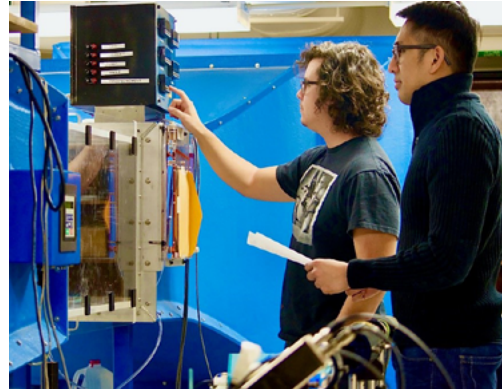


McKenzie Reid spent her summer breaking down machine equipment and sorting it into recyclable parts.

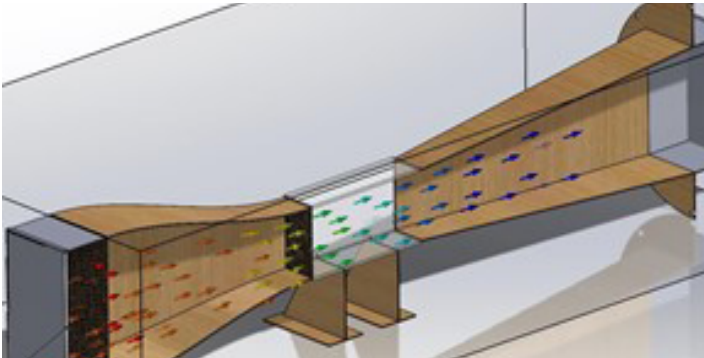
Wind Tunnel Facility and Improvements



(Top left) Students working on assembling the device.



(Top right) Setting up the wind tunnel for aerodynamic load measurement on airfoil.



(Bottom left) Pre-assembly design and validation.



(Bottom right) Assembled exhaust.

Written by Kamal Kumar and Vibhav Durgesh

Research Wind Tunnel

The Experimental Fluid Dynamics Laboratory at the University of Idaho is a 1000+ sq ft research space dedicated to fluid dynamics research and experimentation with an open-loop wind tunnel. This research space has a subsonic research-grade wind tunnel built by Engineering Design Laboratory in Minneapolis. The test section of the wind tunnel has a cross-section area of 1.5 ft by 1.5 ft and 4 ft long.

The wind tunnel has two sets of honeycombs and a mesh screen in the inlet section of the tunnel to reduce the turbulence level of the flow in the wind tunnel. The wind velocity in the wind tunnel can be precisely controlled using the variable frequency controller. The flow velocity in the test section can reach the maximum speed of 100 m/s or around 220 miles per hour. The

wind tunnel facility test section has optical access from all four sides for various fluid dynamics/aerodynamics measurements. The wind tunnel facility has a smoke flow visualization system and includes an oilsmoke generator, a high-intensity spotlight source to illuminate the region of interest.

Recently, a high precision load cell system has been added to the wind tunnel system that allows for accurate measurement of load (lift, drag, and moments) experienced by the test objects in the wind tunnel. The wind tunnel is extensively used for ongoing research on campus and testing prototypes by the local industries.

ME 430 Benchtop Wind Tunnel

Mechanical engineering undergraduate students developed a bench-scale wind tunnel as a part of their coursework (ME 430). This effort was supported by NASA Idaho Space Grant Consortium. A total of 24 students participated in

this project. They worked in teams of two to three members each over three semesters. The entire design, procurement, and construction process were carried out solely by undergraduate students. They worked every week during class hours for three semesters (Spring-2020 to Spring-2021). Due to the unusual public health situation during the Spring of 2020, we transitioned to online classes only four weeks into the term. The Fall 2020 classes were conducted in hybrid mode.

As a result, less than a third of the expected in-person contact hours were available for this work. Even under these unexpected circumstances, the teams participating in this effort were able to accomplish their goal. The wind tunnel is functional, the force measurement and data acquisition systems are in place, and students can predict and validate aerodynamic performance for simple test objects. The project will continue to benefit students in the senior laboratory course for the coming years.

Capstone Suite Remodel Update

Last time we announced Mr. Bob Parkinson's generous donation to be used to renovate our Senior Design Capstone Suite. We are pleased to share that our renovation is moving forward rapidly.

Dr. Maughan and Dr. Potirniche have been working with Design West Architects in Pullman, Washington, to develop detailed construction drawings based on initial concepts presented in previous newsletters. Due to labor force shortages over the summer caused by the pandemic, we are planning to start work toward the end of the fall semester. Currently, the construction drawings have been approved by Idaho state regulatory agencies and will be circulated for bids soon to have the work completed



An artist's rendering of the Capstone Design Suite after renovation.

during Winter Break 2021/2022.

The remodel will include custom branded University of Idaho Engineering whiteboards, new windows that will create an open

feeling in the room, acoustic absorption material to make the room more inviting for conversation, bright Go Vandals colors, and a giant Idaho logo sign to show off our school pride!

UNDERGRADUATE STUDENTS

Team Takes Third in Entrepreneur Competition

By Alexis Turner

A mechanical engineering student team won \$1,000 and third place in the Traditional Business category during the 16th annual Northwest Entrepreneur Competition to launch sustainability and home gym business startups in Idaho.



Base hold design offering 11 different grip positions.

gym rock climbing wall holds called Cruxion.

Their base hold offers 11 different grip positions in one compact device. Stephens said the device

will help local climbing gyms and at-home users save time and effort in setting new climbing routes that would normally require removing every hold and selecting a new singular grip every time a new route is desired.

"Using Cruxion, the choices for different grip positions becomes as limitless as your desire to climb," Stephens said.

The team is further developing its device. This year, the focus will be raising money and taking the device to climbing festivals nationwide. The team hopes to distribute to outdoor and sports companies in winter 2021.

First-Year Students Compete in FFA Ag Mech Nationals



FFA Team Members (left to right) Eli Freeman, Jorey Johnson, Nico Johnson, and Michael Weber. Not pictured: FFA advisor Todd Rightmire.

Incoming ME students, Michael Weber and Nico Johnson competed in Indianapolis in October 2021, finishing fifth as a team. Individuals on the team placed 13th, 14th, 32nd, and 36th.

"Competing during nationals was a humbling experience, and it was an honor to be able to represent our high school and the state of Washington at the competition. Being surrounded by thousands of fellow FFA students from around the was a once in a lifetime experience that I will never forget", said Mike Weber.

New Summer Hobby: Knitting

Coming soon to Palousafest and a Vandal football game near you: Knit your own 4 ½-foot scarf in five minutes!

Engineering seniors Katie Davis, Luis Garcia, Gavin Hewett and Garret Sonnen partnered with U of I College of Agriculture and Life Sciences instructor Chelsey Lewallen to build this knitting bike, bringing more Vandal pride to on-campus events and helping students learn more about apparel, textiles and design.

Our team of mechanical engineers designed and constructed the mobile device that connects a circular knitting machine to a modified stationary bike, allowing the bike user to knit a scarf easily and efficiently.

The project is part of the summer iteration of our Interdisciplinary Capstone Design Program.



VIDEO ON FACEBOOK

See the knitting machine in action at

[Facebook.com/uidahoengr](https://www.facebook.com/uidahoengr)

Engineering seniors Katie Davis, Luis Garcia, Gavin Hewett and Garret Sonnen partnered with U of I College of Agriculture and Life Sciences instructor Chelsey Lewallen to build this knitting bike.

Advisory Board Scholarships Awarded



Garrett Potts

Describe your interests in mechanical engineering and your future plans.

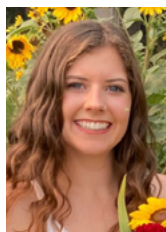
My interests in Mechanical Engineering are control systems, testing, and calibration. I really enjoy the problem solving process of engineering, being able to apply theory to real

world situations and seeing the impact of a project. I plan on a career in the automotive industry after graduation, and to compete in the Clean Snowmobile Challenge for my final time during this coming competition.

Describe how the scholarship funds would make a difference in meeting personal financial need.

I am a transfer student from Modesto Junior College and have only been at

the University of Idaho for about 2.5 years. During my time at MJC and U of I, I have balanced work, school, social and family life. This scholarship will help to alleviate how much time I spend at work and allow for me to focus on my senior year of school and leading the Clean Snowmobile Challenge Team. companies in winter 2021.



Lindsay Guthrie

Describe your interests in mechanical engineering and your future plans.

I am interested in the solid mechanics side of mechanical engineering. This has been an interest of mine since I was little and loved to build things

out of Legos. Figuring out how multiple complex parts will fit together and work in conjunction with one another fascinates

me. I have done a lot of Solidworks design, and I am certified professionally in the CAD software, and I hope to work up to my Expert level certificate. I am interested in the management side to engineering as well. My plans for when I graduate is to go into industry. I do not have a specific field I want to pursue, and I am keeping my options open.

Describe how the scholarship funds would make a difference in meeting personal financial need.

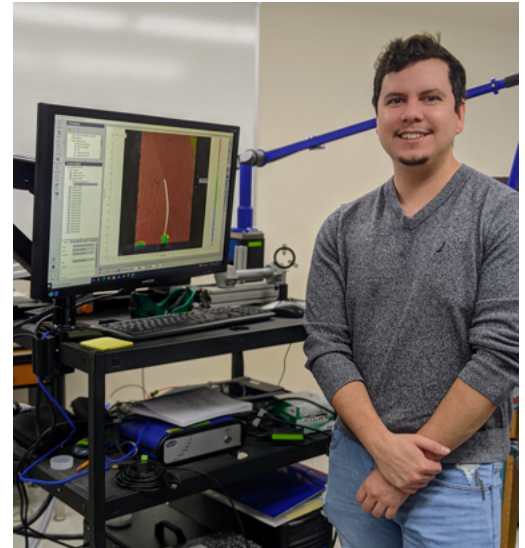
I spent my whole first year in college undecided on my major and I explored a variety of different subjects which lead me to mechanical engineering. Because of this, I am now in my fifth year on campus which greatly impacted my finances since other financial aid only applies for four years of college. This scholarship has helped me transition into my fifth year.

Rodrigo Padilla, Ph.D.

Written by Rodrigo Padilla

Rodrigo Padilla is a first-year Ph.D. candidate in the Department of Mechanical Engineering at the University of Idaho. Earned his master's degree from the University of Idaho in the Fall of 2019 on his studies of "Characterizing Aerodynamics and Flutter Behavior of Flags in a Free Jet Flow." In his studies, he has conducted several experiments to accurately quantify aerodynamic measurements, fluid measurements, and spatial displacement of a fluid-structure interaction (FSI) flag problem. This work earned him a conference publication through the American Institute of Aeronautics and Astronautics. Starting his experimental fluid studies as an undergraduate student at the California State University, Northridge,

Rodrigo aims to continue his journey under the supervision of his PI, Dr. Vibhav Durgesh. With the opportunity to be a fellow for NASA's Idaho Space Grant Consortium, he can dedicate his time conducting FSI studies aimed to understand the phenomenon of flow-induced vibrations. This included creating an experimental setup that combines several systems, e.g., force/torque transducer, particle image velocimetry (PIV), hotwire anemometry, and high-speed imaging. His work aims to further understand engineering applications such as aircraft wing flutter, parachute dynamics, bio-propulsion, energy harvesting, and passive heat transfer. "I've always had a great passion for aeronautics and fluid dynamics. During my undergrad, I learned a lot working in the Fluid Lab at CSUN and while being



Rodrigo Padilla

a team lead in my SEA Aero Design capstone. These opportunities gave me the confidence to finish my Master's and now continue my Ph.D. in hopes to one day work for NASA."

Doctoral Student Earns Student Honor

Written by Yusuf Oduntan

I have been an active member of the African Student Association (ASA) since the beginning of my master's program till date. I joined the association after attending the new students' orientation at the beginning of my first semester and it has been an exciting journey thus far. After attending several ASA meetings, and experiencing the support and commitment of the members, I became really interested in activities within the association and decided to become more involved by joining the planning committee in fall 2018. I assisted with organizing the 2018 Africa Night, the association's signature event and volunteered during the Palousafest and Get Involved fair. In 2019, I became the event coordinator of the ASA. This provided me the opportunity to contribute my



Yusuf Oduntan

quota to the association and give my best with even more devoted time and resources. I worked with other ASA board members to

plan a very successful Africa Night in 2019 by organizing fundraising activities, sourcing for performers as well as developing and improving promotional activities. In addition, I ensured high member attendance and participation in other ASA and campus events including bi-weekly association meetings, Palousafest, Get Involved fair, Saturday of Service amongst others. The ASA was instrumental in helping members get through the unexpected events of the past year together by hosting several virtual events.

Kaitlin Tabaracci, Ph.D.

Written by Kaitlin Tabaracci

I am a first year Mechanical Engineering PhD student from Coeur d'Alene, Idaho. I graduated with my Bachelor of Science in Mechanical Engineering from the University of Idaho in May 2021. Engineering is the opportunity to design something innovative that has the potential to help people. I love engineering because it offers endless opportunities to improve and design things that will have a lasting impact on the world. My senior capstone was redesigning a mobile platform for the Vandal Marching Band. During that project I designed parts in SOLIDWORKS, created engineering drawings, and spent over 200 hours in the machine shop. I manufactured different parts for the project, utilizing machines such as the manual mill, manual lathe, and CNC HAAS mill. I have also been an



Kaitlin Tabaracci

independent researcher under Dr. Daniel Robertson for almost 2 years. During that time, I designed and 3D printed parts for several electro-

mechanical devices. I was also the project lead on the development of a novel, high-throughput, mechanical phenotyping methodology for maize stalks. In this role I led a group of 5 undergraduate researchers to test over 8 thousand maize stalks. I developed the testing protocols and continually optimized them based on user feedback. I also built a database for organizing all the data we collected. The data base will be used by collaborators at several other institutions.

Crepeau Named Interim Dean of College

The University of Idaho College of Engineering has named John Crepeau as interim dean of college. His appointment began June 28, 2021.

Crepeau has been a mechanical engineering faculty member since 1994 and started at U of I as a program coordinator for mechanical engineering at U of I Idaho Falls.

Moving to Moscow in 2009, he served as the department chair for mechanical engineering and has been the associate dean of the college since 2018.



Dr. John Crepeau

With a focus on fluid mechanics and heat transfer, Crepeau has a number of publications and conference presentations in those fields as well as the history of science.

He earned his bachelor's degree in mechanical engineering from the

University of California at Berkeley and his master's and doctorate from the University of Utah, also

in mechanical engineering.

He was a Fulbright Scholar in 2015 to 2016 in Ecuador and was an NSF-NATO Postdoctoral Research Fellow at Humboldt University in Berlin, Germany from 1992 to 1993.

He won the John F. McCarthy Award from the International Council of Aeronautical Sciences and the Jesse and Mabel Hoffman Endowment Teaching Award from the University of Idaho.

Presently, he serves on the Engineering Accreditation Commission of ABET, our college's accreditation organization.

Maughan Earns \$4M to Build 3D-Printing Technology

Written by Michael Maughan and Alexis Turner

The University of Idaho is developing technology to turn Idaho wood waste into one of the most sustainable building construction materials on the market — by using it as a medium for 3D-printing building construction materials.

An interdisciplinary research team led by College of Engineering Assistant Professor Michael Maughan has been awarded nearly \$4 million from the National Science Foundation's (NSF) EPSCoR Research Infrastructure Improvement Program.

Funding through 2025 supports further development and testing of an additive manufacturing process and the design and construction of a 3D printer capable of producing modular wall, floor and roof panels printed from wood for industrial construction.

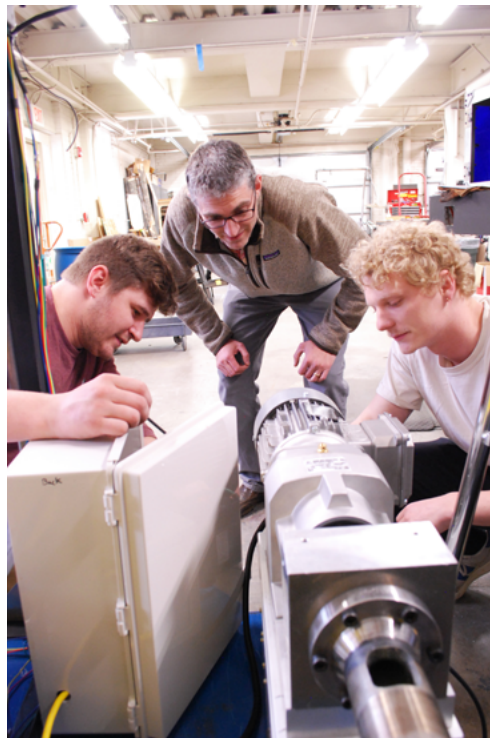
"We're developing a new composite material, using completely bio-based resources on a truly large scale," Maughan said, "With this technology, houses and commercial



buildings can be made entirely differently. We can push past climate change, mitigate impact on our environment and make better use of the natural resources we have."

Working in collaboration with the College of Art and Architecture's Integrated Design Lab and the College of Natural Resources since 2019, the U of I team has developed an advanced 3D-printing technology using a binding agent and wood fibers not used by the lumber market — like waste wood and sawdust from mills and wood processing plants. As part of the NSF funding, researchers from Auburn University will join the team to continue to refine the binding agent used in the renewable material.

The multi-year, 3D-printing



(Left) Using advanced 3D-printing technology, the renewable material uses a binding agent and wood fibers not used by the lumber market.

(Right) Mechanical engineering graduate student Robert Carne (Left to right), Assistant Professor Michael Maughan and recent graduate Conal Thie discuss updates to the motor of a custom-designed 3D printer.

technology project is expected to positively impact Idaho's fast-growing construction industry. According to the U.S. Energy Information Administration, 60% of global waste is produced from the construction sector. With unique carbon sequestration potential, this new 3D-printed material

is expected to reduce that significantly, Maughan said.

The research focus is on the structural properties of printed materials and the continued testing of the material's resistance to fire, water damage, pests and other degrading agents, improving its ability to stand the test of time.

CER Adding Cutting-Edge Measurement System

NSF grant to fund Volumetric Velocimetry System

By *Alexiss Turner and Ralph Budwig*

University of Idaho faculty have been awarded a grant from the National Science Foundation to purchase a cutting-edge measurement system that will help better understand natural phenomena at the surface of and within sediment beds in bodies of water.

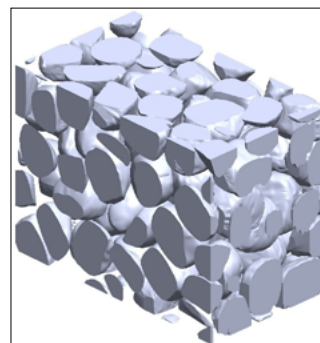
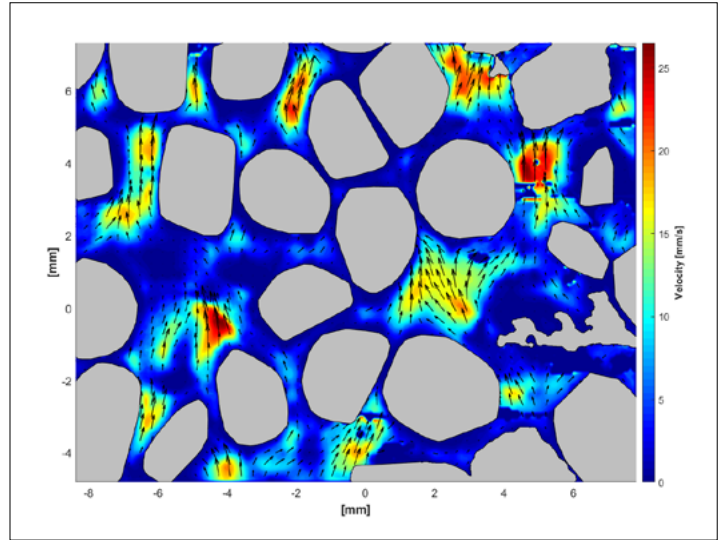
U of I Center for Ecohydraulics faculty Ralph Budwig, Elowyn Yager and Daniele Tonina, along with Department of Geological Sciences faculty Eric Mittelstaedt and Erika Rader were awarded \$241,902 for the purchase of a Volumetric Velocimetry System.

The system can take thousands of velocity measurements in a volume of moving fluid - including air, water, and other clear fluids- in an instant of time. Measurements are made optically, without the need of a probe that can disturb

the flow being measured.

The device will be used to aid current research projects, including understanding the flow around sediment grains like those in salmon egg nests, called a redd. Salmon devote many hours to creating the redd - manipulating the gravel to form it - so conditions are right for eggs to mature and hatch.

“The hypothesis is that they are shaping the redd and sediment grain size distribution such that there will be adequate flow around the eggs to carry the needed dissolved oxygen,” said Budwig, principal investigator on the grant. “We have created a clear sediment simulant so this measurement tool will be able to see the flow into and around the grains. With this tool, we can model the flow through a salmon redd for a number of configurations and flow conditions to test the hypothesis.”



(Top) Volumetric measurements of water velocities in a grain bed model.

(Bottom) Three-dimensional topology of the grain bed model.

Fluid-Structure Interaction Study Earns NASA-EPSCoR Grant

By *Vibhav Durgesh*

Fluid-Structure Interactions (FSI) play a critical role in aerodynamic instabilities. The flutter or oscillations induced due to these instabilities can lead to catastrophic aerodynamic failures. FSI have a vital role in parachute deployment and are a crucial component of space exploration. For example, parachutes are used to decelerate spacecraft when landing on the Martian surface.

Another area where FSI plays a critical role is flexible rotor blade aerodynamics. Unwanted oscillation of the blades due to FSI may make the rotorcraft unstable and lead to catastrophic failure. This

research aims to understand how mechanical and geometrical properties of structures and flow conditions influence observed oscillation modes, the coupling mechanism between structure and vortex shedding, and how these oscillation modes impact aerodynamic loads.

To study FSI flow physics, we plan to use commercially available flexible materials and 3D printed membranes to tailor material properties using a state-of-art 3D printer (funded through NSF-MRI (2020)). We plan to measure fluid velocity, membrane instantaneous position, and aerodynamic loads experienced by the membrane for a range of inflow conditions for this investigation.



Flow visualization experiments showing the fluid flow over the flexible membrane.

To better understand the complex flow physics of FSI, we plan to use the data-driven analysis approaches like Proper-Orthogonal-Decomposition (POD) or Dynamic Mode Decomposition

(DMD). These data-driven analysis approaches would allow us to capture the low-order flow behavior of flutter behavior and aid in predicting the onset of instabilities and aerodynamic failures.

ME Faculty Career Highlights

Tenure & Promotion



Kamal Kumar, Associate Professor

Dr. Kamal Kumar was awarded tenure and promotion to Associate Professor based on his creativity in teaching experimental methods, his innovative approach to system modeling, and his realization of an innovative combustion laboratory with a patent-pending linear compression machine that monitors production of intermediate species during the combustion process. He is student-centered in his approach to engineering education and is committed to using phenomenon-based learning as a tool for inspiring critical thinking about STEM concepts, modeling methods, experiment design, and application of engineering knowledge/skills in solving real-world problems.

2021-2023 University Mid-Career



Joel Perry, Associate Professor

Dr. Joel Perry received a UI Mid-Career award for his design, manufacturing, and testing of the BLUE SABINO that can be used to investigate upper body stroke rehabilitation. He has been able to create a wearable robotics laboratory that can simulate different levels of resistance to normal body motions in the process of physical therapy, collecting data on patient performance during different arm and forearm motions. He leads a robust research group consisting of graduate and undergraduate students whose work products and visual displays delight campus visitors of all ages.

Faculty Advising Excellence Award



Daniel Robertson, Assistant Professor

Dr. Daniel Roberston was recognized with a UI Excellence Award for his advising of Grand Challenge Scholars students, members of his extensive research team on plant biomechanics, and his interaction with undergraduates in the wake of our sophomore design experience that features mechatronics. He is one of our most popular professors and is an advocate as well as a role model for advancing the U of I undergraduate research experience. He is passionate about teaching the next generation of engineers the complexities of plant biomechanics.

ALUMNI

New Advisory Board Member: Matt Soden

Written by Matt Soden

Last year when asked if I would be interested in joining the Advisory Board I knew I didn't have an option but to accept the invitation. The university was foundational for me like so many other alumni however I had a slightly different perspective on it as a transfer student. When I transferred into the Mechanical Engineering Department as a Junior, I felt trepidation that I would be treated as the outsider however the reality couldn't be further from the truth. I was immediately struck by the warm and welcoming nature of both the students and the faculty (other from some good-natured ribbing as the UW kid by Dr. Odom.) Indeed, the next year the University

showed an immense amount of trust by allowing me to be the Formula SAE Team Captain.

These experiences laid the foundation for my last 14 years in the aerospace industry including my current position as a Manufacturing Engineer at Blue Origin. I am thrilled and honored to be a part of Blue's journey to become an orbital launch company and to work with engineers of the caliber that work at Blue. It is a once in a lifetime opportunity to work on a clean sheet heavy lift launch vehicle. As I write this piece, I am onsite at the production facility at the historic Kennedy Space Center supporting the integration of the largest Payload Fairing



Matt Soden

in rocket history! I cannot think of a better motivation than to look at the Vehicle Assembly Building on my way in or to watch a SpaceX launch at lunch.

I would be remiss if I failed to acknowledge the influence of one other person, the great Russ Porter, and the great

education being given in the UI machine shop. While Russ has now retired, I am confident that his legacy of patient tutelage carries on, educating Idaho's finest with the practical skills that have served me so well. Indeed, what I learned has given me the confidence to start a CNC machine shop and vehicle engineering business. I started it as a natural progression from a Vintage Racing hobby into a business primarily limited by the amount of time I can commit. We are finishing our first customer car, a Porsche 962 tribute supercar for the street!

I am thrilled to get an opportunity to give just a little back to the University that has given me so much.



LETTER FROM THE CHAIR

Dear Friends of the Mechanical Engineering Department,

A gratifying part of my job as department chair is to meet regularly with prospective students, many of them high school juniors or seniors aspiring to pursue an engineering career. They visit our department because they are passionate about mechanical engineering and frequently mention that they would like to engage in hands-on design and manufacturing activities, such as machining, 3D printing, welding, or laser cutting. Some are resolute about their wish to enroll in our program, while others are still undecided, as they seem attracted to several other engineering majors as well. As I explain to them the role of mechanical engineering in our society, I often think about our profession's profound impact on our economy. Our department has an excellent tradition of sending out graduates to become successful mechanical engineers in companies across Idaho, Montana, Oregon, Washington, or beyond. These



Gabriel Potirniche, Chair

four states, along with British Columbia, form what is generally called the Pacific Northwest. This region is among the top ten most prosperous in the world by economic output. A significant reason for this prosperity is mechanical engineers' hard work, ingenuity, and dedication.

In mechanical engineering, we teach students a broad spectrum of disciplines applied to thinking about and creating products that permeate our society and improve the quality of human life. We introduce various engineering topics and provide students with experiential learning and practice that prepares them to work as engineers in virtually any industry. The vast majority of our graduates become engineers in companies classified within the aerospace industry, the automotive industry, manufacturing, power plants, the oil industry, the forestry industry, electrical companies, semiconductor technology companies. It is impressive to ponder upon the wide span of industrial activities that a mechanical engineer can cover. The professional successes of our alumni in such a wide variety of endeavors are first and foremost due to their tremendous potential and

diligent work as engineering students, which extended into their professional years. Our department's highly dedicated and skilled faculty members ensure that the mechanical engineering students benefit from solid theoretical training on solid mechanics, materials, fluid mechanics, heat transfer, and thermodynamics. We also provide our students with hands-on design and manufacturing skills that are essential for their success. In addition, students perform assembly, testing, and data acquisition on engineering instrumentation and systems in laboratory courses or our two-semester project-oriented capstone design course.

Students experience outstanding growth in our program. As fresh enrollees in our department, they have some ideas about what it is like to be a mechanical engineer. By the time they graduate, they become well-rounded on all topics of the undergraduate program. Our students' very high passing rates on the Fundamentals of Engineering (FE) exam is yet another proof of their solid preparation. The FE exam is offered nationwide and administered by the National Council of Examiners for Engineering and Surveying (NCEES). It represents an excellent opportunity to get

an unbiased and independent assessment of students' level of preparation on engineering topics during their four-year program in our department. In recent years, our students have done an excellent job in the FE exam. For instance, during September-December 2020, our students recorded a 100% passing rate in the FE exam, and during January-May 2021, we recorded a 90% passing rate. Our students also score consistently higher than the national averages in most exam areas related to engineering economics, ethics and professional practice, solid mechanics, electricity and electromagnetism, statics, dynamics, kinematics, vibrations, mechanics of materials, fluid mechanics, thermodynamics, and mechanical design and analysis.

Each semester we interview our graduating seniors on their opinions about the most pressing contemporary issues that face our society. Examples of critical areas identified by students are promoting green engineering, identifying alternative energy sources, improving infrastructure, improving health and well-being by producing innovative engineering solutions, and advancing personalized learning.

GIVE TO THE MECHANICAL ENGINEERING DEPARTMENT

Support the ME Department, through:

- Scholarships
- Student travel
- Senior design project support
- Competition team support
- Facility upgrades
- Equipment donation

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