Spring 2022

University of Idaho
College of Engineering

MECHANICAL ENGINEERING NEWS

RETIRING FACULTY

Leaving a Legacy of Excellence in Education and Research

Three Pillars of the Mechanical Engineering Department to Retire this Summer

Written by Gabriel Potirniche and Eric Wolbrecht

Dr. Steve Beyerlein, Dr. Ralph Budwig, and Dr. Edwin Odom are retiring after long and distinguished careers as Professors of Mechanical Engineering and will transition to Emeritus Professor status. Our department greatly appreciates their tremendous impact on our program and is thankful for their contributions on so many different levels. Their professionalism, hard work, vision, and wisdom have shaped our department into a center of excellence in engineering education. Under their stewardship and mentorship, the M.E. department has achieved outstanding results in other areas such as cutting-edge research, service to the university and professional organizations, and outreach to inland northwest communities.

Dr. Steven Beyerlein worked as a nuclear engineer with Stone & Webster before joining our department. He started at the University of Idaho in 1987 as an assistant professor. His educational impact in our department has been truly outstanding. Over the years, he has mentored students, staff, and faculty members while teaching a vast array of courses on mechanical design, solid modeling, thermodynamics, kinematic analysis, senior lab, fluid mechanics, building energy and environmental

Dr. Steven Beyerlein, active at Univ. of Idaho 1987-2022

Dr. Ralph Budwig, active at Univ. of Idaho 1985-2022

Dr. Edwin Odom, active at Univ. of Idaho 1991-2022

IN THIS EDITION

policy, lean manufacturing, advanced computer-aided design, combustion engines, and air pollution.

"I witnessed Steve's systematic, positive effect on the program. I suspect his influence will be felt for many, many years. Steve's devotion to his students, graduates, staff, fellow faculty, and to his industrial partners is without question." ~Jeff Smutny, BSME 1994, MSME 1998

Dr. Beyerlein performed his research work on design pedagogy, formative assessments, applied thermodynamics, combustion engines, experimental design, student-centered learning, and faculty development. He received many awards and published numerous book chapters and journal papers on both technical and engineering pedagogy subjects, as well as acting as a reviewer for several professional organizations and editorial boards. For the last ten years, Dr. Beyerlein has been very active in performing energy engineering outreach through the Department of Energy Industrial Assessment Center program.

Dr. Beyerlein has had a remarkable impact through his service at the university level in various committees concerned with diversity and inclusion, assessment, online education, general education, finance, outreach and engagement, honors, Design Expo, and more. He has been active in several professional organizations throughout the years.

Dr. Ralph Budwig worked as a post-doctoral research associate with the Naval Postgraduate School after graduating from John Hopkins University. He followed up with a visiting position at the University of Ottawa. In 1985 he joined our department as an assistant professor. Dr. Budwig held several academic administrative appointments, such as the Director of the Center for Ecohydraulics Research (CER) in Boise and the Chair of the Mechanical Engineering Department.

He specialized in fluid dynamics and turbulent transport. He has been researching time-varying flows and coupled heat and mass transfer phenomena. He taught numerous courses, mainly at the junior, senior, and graduate levels focused on experimental methods in flow dynamics and heat transfer, unsteady flows, convective heat transfer, HVAC (heating, ventilation, and air conditioning) systems, transition to turbulence in fluid flows, droplet hydrodynamics, mass transfer, measurements of turbulence, gas dynamics and data acquisition systems.

"I will always be appreciative of everything that Dr. Budwig did for me. His kindness and mentoring meant a lot. Dr. Budwig was also interested in my career aspirations after I graduated. He cared about each student and their ultimate goals and helped me work towards those goals." ~ Courtney Hollar, PhD 2019

Dr. Budwig has been heavily involved in the development and delivery of laboratory courses for undergraduate and graduate students and web-based courses for distance education. He mentored many graduate students and has been a faculty advisor to student teams competing nationally on human-powered vehicles and reduced gravity projects. He sponsored numerous senior design projects.

Dr. Budwig has had a prolific publication activity in his research areas with numerous book chapters technical papers in journal and conference proceedings. Dr. Budwig gave presentations at multiple international and national conferences. He secured significant research grants from governmental agencies, public and private corporations, and various foundations, which have been instrumental in growing the research at the CER in Boise. Most recently, Dr. Budwig has been researching topics such as riverbed architectures, interstitial transport processes within granular sediment riverbeds, biophysical ecology in rivers, energy performance of 3-D printing of wood structures, and control systems for HVAC systems.

Dr. Budwig also performed significant service to the university by working on committees tackling problems such as budget and finance, faculty senate activities, graduate student activities, affirmative action, fiscal management, awards management, engineering executive council, promotion and tenure policies.

Dr. Edwin Odom joined our department in 1991 as an assistant professor. Before that, he was 2nd Lieutenant and shop officer in the U.S. Army and worked as a mechanical engineer and manager with General Electric. Dr. Odom taught classes at all levels, focused on freshman introductory experience, material processing and selection, machine design, mechanics of materials, solid modeling, advanced solid modeling, mechanical systems design, fracture mechanics, experimental stress analysis, and elasticity. His rigor, passion, and selfless dedication to educating students on mechanical design topics have put an indelible mark on the quality of our program. Dr. Odom has been a great advisor and mentor to many undergraduate and graduate students. He has guided them toward completing their research or applied design projects.

"I've always felt a step ahead of my colleagues when it comes to machine design. I know this is directly related to the courses I took from Dr. Odom on these subjects. Stress analysis, shear and bending moment diagrams, fatigue analysis; those things were so drilled into me I'll never forget them. Dr. Odom also had a curiosity about why parts were designed a certain way and would have us investigate as part of our coursework. This curiosity and thoughtfulness have stuck with me in the years I've practiced as an engineer." ~Mike Thompson, BSME 2006

Dr. Odom's research publications focused on power trains for vehicles, stress analysis in composite materials, describing geometrical properties of cross-sectional areas, and experimental methods for materials testing. Dr. Odom participated at numerous conferences and scholarly meetings, publishing research papers in the proceedings the events. Due to his and Dr. Beyerlein' s efforts, our senior capstone design program was acknowledged for its high quality and ranked as the top seven in the nation by the National Academy of Engineers several years ago.

Dr. Odom spent a significant amount of time educating students on using the equipment in our machine shop. He was instrumental in securing substantial funding that allowed our department to acquire the Haas Tool Room Mill. He performed extensive outreach work to industry via capstone design projects and participated in numerous professional development activities.

VentureWell Grant Enables Innovative Capstone Design Projects

Written by Matthew Swenson

A recent grant from VentureWell was awarded to Dr. Matthew Swenson that will help strengthen the relationship between University of Idaho Engineering and the statewide Invent Idaho program. Each spring, following the Invent Idaho regional and state competitions, several Invent Idaho participants (1st -12th grade) will be selected and invited to be paired with an undergraduate mentor. At the same time, volunteer undergraduate student mentors will be recruited to participate in mentoring. Through coordination with parents, ~10 mentoring sessions ranging 30-60 minutes long will be conducted via Zoom between the Invent Idaho participants and the undergraduate students. Discussion topics included design ideas, product messaging and pitch, and potential applications for the invention. If appropriate, the mentor may help with simple prototyping involving 3D printing or laser cutting of components to help design visualization. Following the mentoring sessions, three participants will be invited each year to present their invention ideas at the Annual Engineering Design EXPO on the U of I campus.

At the conclusion of the Invent Idaho competitions, funding from the 3-year VentureWell grant will enable creation of 2-3 capstone projects each year in partnership with Invent Idaho participants to further advance their design ideas. Interdisciplinary teams of undergraduate capstone students will be assigned to each project, with the young inventor positioned as the “client” for the project. While the capstone team is given autonomy to define their own direction, the young inventor will be invited to be an extension of the team on the project, attending key milestone events including the kickoff meeting, formal design reviews, and presentations, providing input and perspective from their own learning experiences. Project teams are charged with designing and building a fully functional prototype of the invention, potentially resulting in a formal Invention Disclosure submitted to the Office of Technology Transfer (OTT). Dr. Swenson is extremely grateful to the VentureWell organization, which has a mission to create a pipeline of inventors and entrepreneurs, providing resources and opportunities for students to realize their full potential.

Building Programming Skills for Mechanical Engineers

Written by Ankit Gupta and Eric Wolbrecht

Starting in the Fall of 2022, the Mechanical Engineering undergraduate curriculum will include a new course: ME 280 Programming Essentials for Engineers. This course has been designed with the needs of incoming students in mind and will provide hands-on experience in programming applied to mechanical engineering problems. Students will be given an overview of programming concepts and will cover all the essential elements of programming and problem-solving. Learning programming skills early in their undergraduate education will broaden and enhance students’ capabilities in their future coursework, research endeavors, and senior capstone projects.

Programming is a critical skill for modern engineers. A good programmer is by necessity a good problem solver, and programming is an essential and powerful tool that engineers use to solve the world’s most challenging problems.

Graduates from our program already have a strong reputation in the industry as highly capable mechanical engineers with a broad set of skills and abilities. Adding additional emphasis on programming in our curriculum will give our graduates another tool for solving engineering problems, and better align their skills with the needs of industry and innovation.

This course will introduce students to Python, a high-level open-source programming language known for being versatile and beginner-friendly. It can be used in almost any kind of environment, including hardware development, industrial automation, mobile applications, web development, and desktop data analysis. Python is also a very popular language for research, development, and innovation.

ME 280 Programming Essentials for Engineers will cover fundamental programming concepts including loops, logic, functions, and conditional statements. More advanced topics will also be explored, such as reading and writing to a file, third-party libraries, and data plotting and visualization. After completing this course, students will have the necessary foundation to be successful in future courses that feature programming assignments, including Mechanical Design Analysis, Dynamic Modeling of Engineering Systems, Computational Fluid Dynamics, and Finite Elements Analysis.

Frank W. Harris Endowed Scholarship

Frank W. Harris

The Frank W. Harris Memorial Mechanical Engineering Scholarship Endowment was established in early 2022 by the generous gift of Mrs. Karen Harris, Frank's wife. The scholarship endowment honors the life and legacy of Frank W. Harris and recognizes the positive impact of the University of Idaho on his life and engineering career.

Frank was always appreciative of the positive impact that his UI College of Engineering Mechanical Engineering degree had on his professional life. The $300,000 endowment gift was provided by Mrs. Karen Harris. Because endowments invest the initial donation and the College of Engineering uses its annual return for scholarships in perpetuity, this donation will provide scholarships to undergraduate students in the Mechanical Engineering department for many years to come.

Our sincere gratitude goes out to Karen Harris for creating this scholarship fund that will help generations of engineering students at the University of Idaho.

Born in Wallace, Idaho, Frank W. Harris graduated in 1967 with a B.S. degree in mechanical engineering from the University of Idaho. After graduation, he worked for Rocketdyne on the J-2 project, which involved testing second stage engines for the Saturn-5 rocket used in NASA's Apollo moon landing program. It was a high point of his life. At that time, he met his wife, Karen Anderson, whom he married in November 1970.

Beginning in September 1970, Frank worked for Pacific Telephone Company, from which he retired in 1994. He initially wrote timeshare programs for Network Operations and later became a Manager in Contracting and Supply in the San Francisco Bay Area. Frank was recognized as a primary creator and contributor to Pacific Bell's Minority/Women-owned Business Enterprises, acting as a mentor to many smaller businesses in the high technology area. In 1999, Frank and Karen moved to the central coast of California, where Frank volunteered as Director/President of their development's private water company. He was active as a Director until January 2021.

Frank was an avid jogger and liked swing dancing, visiting zoos, national parks, and snorkeling in warm ocean waters. He sadly passed away in December 2021, but his memory will live on, both through his professional accomplishments and his positive impact on our undergraduate program for years to come.

Dennis and Norma Jean Hanson Scholarship

Attracting and retaining excellent students who demonstrate the ability to thrive professionally strengthens our department and college. The newly established Dennis and Norma Jean Hanson Scholarship recognizes two outstanding students by supporting approximately half the cost of their annual in-state tuition. The first recipients received the award in fall 2021.

The Department of Mechanical Engineering highly appreciates the generous support that Dennis and Norma Jean have provided through this scholarship. Scholarships of any amount make a significant difference in students' lives and academic success.

Dennis '21 and Norma Jean '77 provided this generous gift to encourage higher education of youth and to promote education in Idaho. Dennis was inducted into the University of Idaho Academy of Engineers in the fall. Dennis also received an honorary doctorate in engineering from the U of I in December 2021.

Dennis grew up in Palouse, Washington, and worked on his family-owned engineering and manufacturing business RAHCO. He has been a successful businessman and philanthropist, bringing substantial contributions to several economic, technological and scientific activities in the Pacific Northwest and beyond. He helped grow RAHCO into a world leader in designing and manufacturing construction equipment. Through his dedication, hard work, and technical acumen, Dennis successfully turned around and grew companies such as Fasteners Inc. and Dye Seed Inc.

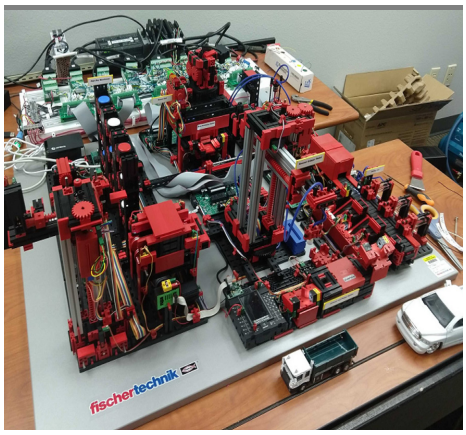
Norma Jean is a third-generation Vandal. She earned a Bachelor's in Microbiology from the U of I in 1977. Dennis and Norma Jean have three sons with Masters of

Dennis and Norma Jean Hanson

Science degrees in mechanical engineering from U of I and a daughter with Ph.D. in biological engineering from MIT. Dennis taught Norma Jean and all four children to fly, and they remain active in aviation as a family today. Today, Dennis and Norma Jean fly a Daher TBM 940 airplane, in pursuit of mountain biking, skiing, travel and grandchildren, having flown to Europe and Central America.

Simulation Factory Established in the New Robotics Laboratory

Written by Gabriel Potirniche and John Shovic



Fishertechnik Simulation Factory

A $15,000 donation was provided by Schweitzer Engineering Laboratories (SEL) to purchase a Fishertechnik Simulation Factory. Jonathan Richards, an SEL engineer and Chair of our department's advisory board, has been instrumental in helping the department procure this equipment. The Fishertechnik Factory will be located in the newly established Robotics Laboratory in the McClure building.

The Fishertechnik Factory has several advantages over traditional PLC simulators. Students build a control system for an entire multi-faceted automation system rather than just a small set of components in classic programming logic controllers (PLC) trainers. The factory includes multiple motors, pneumatic systems, suction systems, plungers, conveyor belts, and three robotic arms. All told over 100 sensors and actuators, giving the students a natural feel for a complete factory system, with all the peculiarities and problems involved. To provide the best experience for our students, the factory uses an actual industrial PLC to control the factory rather than a simulated one.

The plan is for students to learn how to use PLCs to simulate factory operations and implement industrial automation ideas. Dr. Gabriel Potirniche (Mechanical Engineering) and Dr. John Shovic (Computer Science) have finalized the equipment. Dr. Shovic is currently assembling the facility in the Coeur D'Alene campus, and the factory will be shipped to Moscow and placed in the robotics lab at the end of April.

Ray Anderson (Director of Technical Services in the College of Engineering) is working with Dr. Potirniche and Dr. Shovic to establish a videoconferencing system in the new robotics lab. The video link capability will connect the Moscow and Coeur D'Alene campuses. This will facilitate the teaching of courses and project work between the student and faculty groups at the two locations.

By early summer 2022, the installation of the simulation factory and videoconferencing system will be completed. In the fall 2022 semester, Dr. Shovic will teach the *ME 404/504 PLC Programming/Automation* course from Coeur D'Alene to students located on the Moscow campus. At this point, we plan to offer access to our mechanical engineering students to robotics and machine vision courses taught by Dr. Shovic from Coeur D'Alene. We want to establish an addiction facility that will include two cooperative robots (Cobots) in the new robotics lab in the long term.

Our efforts to develop infrastructure, teaching and research capabilities recognize the significant trend across many industries toward the rapid adoption of intelligent automation and robotics systems. We envision that mechanical engineering students will be trained in the future to program Cobots using Artificial Intelligence (AI), machine vision, and other embedded systems applications. We strongly believe that such skills will benefit students in their careers as interns or full-time engineers. We are grateful to SEL for this generous donation.

Design Suite Update: Phase 2 Renovations

Written by Mike Maughan

Building on momentum from the summer and fall, winter break saw significant progress toward the completion of the second phase of the design suite remodel. Improvements have now been made to every aspect of the room. Most recently, ceiling tiles, new lighting, new cabinets, and other enhancements have been installed. The room has also been painted in striking Vandal colors to produce a dramatic and inspiring effect in the room. The ceiling tiles remove the echo that would previously occur in the room whenever a sound was made, and the new led light fixtures provide consistent illumination in the room.

Since spring break, an amazing 7-foot-tall lighted Vandal sign was installed above the door into the back room. We also continue to work with our partners in UI Architecture and Engineering Service and Design West Architects to obtain custom Vandal-logo whiteboards that will provide a place for those all-important brainstorming discussions that occur in the design suite. While delays from the suppliers have occurred, the white boards should be installed before summer session starts.

We again want to express appreciation to Bob Parkinson for the generous donation, which has enabled this transformation. Opportunities to support completion of the back classroom, which will feature lounge and presentation spaces, are still available. Contact Bobbi Hughes, Executive Director of Advancement (bhughes@uidaho.edu) if you are interested in donating.

INFRASTRUCTURE IMPROVEMENTS

Agricultural Mechanics Laboratory (AgMEQ) moves into Gauss Johnson

Written by Daniel Robertson

Dr. Robertson (center) and graduate students Yusuf Oduntan, Clayton Bennett, Joe Dekold, and Kaitlin Tabaracci (left to right) conducting field work at collaborators sites in Lexington, Kentucky.

Over the past year Dr. Robertson and his graduate students have been hard at work collecting material property data on an association panel of over 20,000 maize stalks. The team uses custom built electromechanical devices manufactured here at the University of Idaho to characterize the structural bending stiffness and strength of crops that are susceptible to wind damage. This information is used in conjunction with collaborators at Clemson University and the University of Kentucky to identify the genetic underpinnings of plant strength.

Dr. Robertson says, "we currently lose an average of 10% - 15% of our global harvest due to plants breaking in windstorms."

As part of a six-million-dollar grant from the National Science Foundation the AgMEQ laboratory works with geneticists, agronomists, crop modelers and statisticians to develop multiscale, multiphysics models that can be used by plant breeders to relate genomic information to agricultural traits of interest.

The lab recently moved into a new space in Gauss Johnson 119 where the team is conducting additional laboratory tests on the maize plants they analyzed this past summer.

UNDERGRADUATE STUDENT NEWS

ASME Accomplishes Key Goals

Written by Rachel Stanley

The University of Idaho's American Society of Mechanical Engineers club has accomplished several key goals this past year. We wrapped up our lounge upgrades with a big screen TV hooked up to a computer, webcam, and wireless microphone. The setup has already been used for multiple virtual tours and meetings. The lounge's popularity continues to grow with recent improvements and available amenities, it can even be tough to find a place to sit at times.

Rachel Stanley, Paper Tower

Our research led us to find a wonderful Black Friday deal on Arduino kits and we were able to sell thirty upgraded Arduino MEGA kits for the same price as the standard kits sold in previous semesters.

The club also hosted a virtual tour of the Idaho National Laboratory, including: the Advanced Test Reactor, the Transient Reactor Test Facility, the Hot Fuel Examination Facility, and the Energy Systems Laboratory. In addition to the tour, we have hosted an informational meeting led by National ASME student section leadership and multiple small design competitions, including a paper airplane and paper tower contest.

Shane Elmose, Paper Tower

After a long break from in-person tours, the ASME club is excited to announce a small, in-person industry tour scheduled at Clearwater Paper on March 29! We look forward to providing more in person tours and opportunities in the future.

Clean Snowmobile Team Achieves Podium Finish at 2022 Competition

Written by Garrett Potts

The 2022 Clean Snowmobile Challenge marks the 23rd event to be hosted by the Society

Garrett Potts -Endurance Event

of Automotive Engineers in this series targeting better exhaust emissions and sound characteristics of snowmobiles.

In additions to those main points, other categories such as acceleration, endurance, and marketability are taken fully into consideration. To achieve these goals, undergraduate students (predominantly engineering) form sub teams for projects they see through fully. Students learn skills of engineering and

Lukas Willits -Cold Start Event

project management, but also learn technical writing and team building. These projects allow for University of Idaho's students to fully engage with other students from different schools, industry professionals, and event organizers. University of Idaho placed 3rd overall, which is Idaho's first podium finish since 2014! In addition to overall placement, U of I placed 1st in acceleration with rider Will Thielman, 2nd in emissions, and 1st in subjective handling. Some areas we plan on improving in the future are sound reduction, technical writing skills, and fuel economy!

Student Profile: Sebastian Garcia

Written by Sebastian Garcia

I am a senior in the Mechanical Engineering department and am very blessed by having the opportunity to pursue a degree at the University of Idaho. However, without the sacrifice and dedication of my family, the completion of this degree would have never come to fruition.

When I first arrived at the University of Idaho, I thought that engineering was conducted in solitude but have slowly learned that the best engineering is often rooted in great teamwork.

Throughout my degree, I have had the unique pleasure of working very closely with outstanding professors from a wide field of disciplines. Their mentorship will fuel my interests in engineering well into the future. Furthermore, over these past years I have met very talented, yet very humble fellow engineering students who will undoubtedly blaze new trails in science and engineering.

While working on my undergraduate degree, I have participated in several on campus clubs, organizations, and research initiatives. I currently serve on the officer board for the Grand Challenge Scholars Program and was recently the recipient of the "Richard T and Bonnie L. Jacobsen Engineering Assistantship" after pitching a research proposal to the Idaho Academy of Engineers. I would like to hank Dr. Daniel Robertson for extending the invitation to join his research initiatives in the UIdaho AgMeq Laboratory.

During the summer of 2020 I was able to participate in ISGC-NASA research studying atmospheric gravity waves. This research initiative included an expeditionary trip to Chile, South America for data collection during the 2020 South American Total Solar Eclipse. As with every research experience I have participated in, the data collection team from UIdaho was outstanding to work on and prepared at length for this field mission.

For my senior year, I have worked under Dr. Vibhav Durgesh in his experimental aerospace lab studying fluid structure interactions as a part of a NASA funded grant. This research has further set the precedent for my future interests, and I am very grateful for his mentorship, and that of his graduate students, as well as their patience in assisting me throughout the research.

To cap this off, working on my capstone team has been one of the highlights of my engineering curriculum. They have proven several times over how hard work, humility, and dedication are the essential working components behind any successful project.

(NASA team Team (L to R) Garrett Wells, Connor Braase, Kristie Olds, Sebastian Garcia, Parker Piedmont, Malachi Mooney-Rivkin, Christopher Wiegert, Ian Glasgow (not shown)

UI Boise Mechanical Engineering Students Win National Challenge

Written by Damon Woods

(L to R) Jason Talford and Tias Mitchell

This fall, two UI Boise Mechanical Engineering graduate students Jason Talford and Tais Mitchell entered a national competition known as *Jump into STEM*. This challenge, which is run by the Department of Energy included a design track on how to best provide equal access to healthy indoor air. Jason and Tais both work as research assistants at the University of Idaho's Integrated Design Lab (IDL) in Boise. At the IDL, they work with both engineers and architects to minimize energy consumption in buildings.

As part of a directed study course this fall, under IDL director Damon Woods, the students focused on common ventilation issues within residential construction.

Jason and Tais were inspired by a window mount device built by BSU professor Brian Wiley, that they dubbed Easiair. Originally designed to provide clean air during wildfire season, the device uses an inline fan to bring fresh air in through a HEPA grade shopvac filter. The students appreciated the device's simple design and analyzed several IAQ implications beyond its intended function. It is expected that the device can reduce CO2 buildup from indoor sources, remove airborne particulates from the outside air, and reverse infiltration through the building envelope. This last item is important as it prevents contaminants such as mold, radon, and pathogens from entering the home.

The cornerstone of this competition and the Easiair design is to provide healthy indoor air to those that disproportionally lack access to it. The students demonstrated how this design provides a holistic solution that can be built inexpensively with readily available parts and has no installation costs, making it perfect for renters and low-income houses. Based on their work and analysis, Jason and Tais were named the winner of their challenge track.

Read more online:
https://jumpintostem.org/ui22/

Faculty and Students Present Research at American Physics Society Meeting

Written by Vibhav Durgesh

Last year the experimental fluids research group traveled to Phoenix, Arizona, to attend the 74th Annual Meeting of the American Physics Society – Division of Fluid Dynamics (APS-DFD) annual conference (https://www.apsdfd2021.org/).

APS-DFD is one of the biggest fluid dynamics/ aerodynamics conferences attended by over three to four thousand researchers worldwide. This meeting has over 1000 presentations, invited talks, plenary sessions, and exhibits and allows the researcher to present their latest findings and results to the research community during 15-minute presentations. During this 74th annual APS_DFD meeting, we had three presentations in very diverse areas.

Dr. Paulo Yu presented the first talk on his experimental work and application of the advanced data analysis approach to understand the complex fluid flow in brain aneurysms. His results showed that we could use modal decomposition methods to extract physically important flow features and understand their impact on the flow in an ideal saccular aneurysms model. The second talk was by Rodrigo Padilla, and his presentation was on the flutter in the flag. He used the Proper Orthogonal Decomposition (POD) technique to quantify the Fluid-Structure Interaction behavior of a fluttering flag and its impact on aerodynamic behavior.

(L to R) Rodrigo Padilla, Paulo Yu, Dr. Vibhav Durgesh, Kirk McKenzie, and Piyush Basnet

The third presentation was from Brandon Hillard, and his presentation focused on using Planar Laser-Induced Fluorescence (PLIF) to extract velocity fields from the actual movement of the fluorescent dye in a porous media. His work is focused on hyporheic flow or flow that travels between the surface and subsurface domains of rivers and streams.

Graduate Student Profiles

Ian Glasgow and Ryan "Jack" Gonzalez are both gradating this spring with master's degrees in Mechanical Engineering. Along with Dr. Edwin Odom, they have been teaching the Solid Modeling, Simulation, and Manufacturing Capstone (ME 490) since the spring of 2020. In the class they prepare students to take eight SOLIDWORKS certification exams concluding with the Certified SOLIDWORKS Expert Exam. Students that pass the exam are in the top 2% of SOLIDWORKS users worldwide. They also teach students basic skills on the vertical/horizontal bandsaw, drill press, lathe, mill, and CNC lathe. This spring semester 2022, both Ian and Jack have been teaching Finite Element Applications (ME 458/558, where they teach students the finite element method as well as how to use the finite element analysis software Abaqus. Class topics include the truss elements, beam elements, frequency analysis, buckling, and plasticity models. Both Ian and Jack have worked as research assistants for Dr. Eric Wolbrecht, performing mechanical design work on a finger exoskeleton designed to rehabilitate stroke victims. This research dealt with additive manufacturing-based design, carbon fiber infused plastics, and a wide range of human factors.

In August of 2020, **Ian Glasgow** became a research assistant to Dr. Edwin Odom. They study clock design, specifically fusees. A fusee is a mechanism to normalize the torque curve of a spiral spring. This research concluded by developing a system of programs to automatically generate the G-code for a Haas CNC lathe to manufacture the threads on a fusee and SOLIDWORKS to automatically generate a solid model of a fusee for any given spiral spring and torque output.

"My projects have developed me into an engineer and a person I am proud to be, and I couldn't have done it without the resources provided to me by the mechanical engineering department at the University of Idaho." ~Ian Glasgow

Jack Gonzalez researched the pedagogy of SOLIDWORKS education at the University of Idaho.

Jack knows that 3D CAD is one of the most requested tools by industry partners for students to know when they leave school and he's striving to help the department develop the best possible program to aid student success. He helped several University of Idaho Capstone groups with the manufacturing of their projects. He enjoys working with the capstone teams, seeing them learn each step of the development process. Working on the robot changed his idea of what engineering is and what it can be.

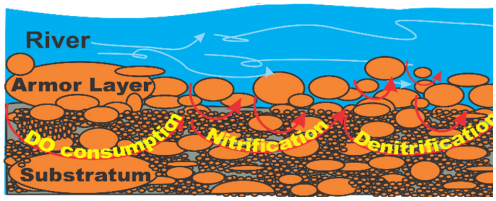
"Engineering, to me, is the process of improving the world around you in a way that inspires questions and discovers well-reasoned solutions." ~Jack Gonzales

Stream-Streambed Processes

Written by Ralph Budwig

The stream-streambed interface is a region of rich interaction where fish spawn, where biofilms attach to sediment grain surfaces, and where a myriad of organisms dwell within sediment grain pores and attached to grain surfaces. Fluxes of water from the stream move slowly through the streambed where solutes (for example, nitrates or phosphorus from anthropogenic sources) are taken in by organisms and released as transformed products.

The faculty at the Center for Ecohydraulics Research (CER) are leading both laboratory and field studies to gain understanding of the processes that occur at the stream-streambed interface. CER's research is supported by novel laboratory flumes and field instrumentation,



which allow them to uniquely answer applied questions on water quality and river management and fundamental questions about biogeochemistry, sediment transport, fluid mechanics, and stream-streambed exchange.

An area of growing interest to scientists and society is flow and biogeochemical processes at the interface between water (streams) and the sediment (streambed), which have key water quality and ecological impacts on riverine systems. To address these processes, we recently developed a novel state-of-the-art flume that consists of simulated transparent sediment that matches the refractive index of nontoxic simulated stream water (Aquatic Imaging Flume – AIF). This allows us to "see" through the riverbed to quantify processes occurring at the stream-streambed interface, which was not previously possible at spatial scales important for river systems. This AIF has allowed us to be more competitive with external funding with four recent research grants (~$1.75M from NSF, National Academy of Science, and California Water Board) including NSF funding for a state-of-the-art, 3D Volumetric Particle Image Velocimetry system. With these unique capabilities CER is positioned to develop a large-scale NSF Center of Excellence proposal on engineering, ecological, and biological stream-streambed processes.

FACULTY AND STAFF NEWS

Homemade Creep Testing Frame

Written by Bob Stephens

When the COE restructured a year ago and Indrajit Charit, professor in material science, moved to Idaho Falls to become the Department Chair of the Idaho Falls Center, he took with him a valuable piece of experimental equipment, a creep testing frame. At the same time, Bob Stephens, professor in mechanical engineering, had just secured a major grant with Electric Power Research Institute (EPRI) to study the creep and fatigue behavior of nickel-base and stainless-steel alloys. Performing the proposed creep (sustained loading) experiments on the servo-hydraulic fatigue frames he has in his lab was not practical.

To purchase a new creep testing frame was close to $100,000 so he and his graduate students, Tony DeSantis and Cody Gibson, got creative. They bought a 20-ton shop press for $250, made simple modifications, and developed a 30:1 load ratio lever arm. With the support of the Mechanical Engineering Department, as well as the College of Engineering, they purchased a laboratory furnace to couple with the testing frame. Using equipment procured from a previous research grant, they integrated an existing power supply, extensometer, data acquisition system (DAQ), along with a few other necessary electronics and components. After everything was assembled, the total investment was less than $15,000 and was built in less than one month.

Tony has since performed three creep tests on it as part of his MS degree.

"Although it might not be the most aesthetically pleasing creep frame out there, and we've got it held together temporarily using a lot of C-clamps, it has worked great and allowed Tony move along much quicker on his research." ~ Bob Stephens

Tony DeSantis, MS student, checks the alignment and placement of an extensometer positioned within the creep furnace.

ALUMNI NEWS

New Advisory Board Member - Bryan Riga

Director of Strategy and Innovation at Idaho Forest Group

I graduated from the University of Idaho with a Bachelor's in Mechanical Engineering and a Master's in Nuclear Engineering. Last year I accepted the Mechanical Engineering Advisory Board position, and I could not be more honored. My mentors and the teachers at the U of I gave me the foundation to launch my career that led me to Silicon Valley, where I experienced two successful startup companies. I had the opportunity to work with- and learn from- the first woman to take a Silicon Valley company public and was an early-stage employee at Talkdesk, which is now number 17 in the Forbes Cloud 100.

The U of I built my foundation and the decade that I spent in Silicon Valley taught me how to thrive in a competitive, evolving environment. Now I am grateful to be back home in Hayden, Idaho, with my wife, Niki (a Vandal), and my son, Christopher (a future Vandal). Integrating my technology background with my roots, I became the Director of Strategy and Innovation at Idaho Forest Group and am leading the implementation of our A3 Program- Academics, Analytics and Artificial Intelligence. We're in the process of innovating the forest products industry- like in Lumberton, Mississippi (where I'm writing from), we are building North America's most advanced lumbermill. I am sitting beside two fellow Vandals discussing how we can remove forklifts from an industry so heavily dependent on them. As a company, we are making significant strides to break the mold in traditional lumber processing by engineering, machining, and fabricating our own machinery to improve throughput and make jobs more desirable. Even more exciting, we are pioneering new concepts that will launch our company into areas we never thought possible.

Since taking on this advisory board position, I have had the opportunity to spend time with many professors who helped shape my time at U of I and could not be more pleased to be part of this incredible team. I am grateful for this opportunity and look forward to giving back to the Mechanical Engineering department that has given me so much.

LETTER FROM THE CHAIR

In my previous letter from the fall 2021 edition of our bi-annual Mechanical Engineering Magazine, I was talking about, what I believe, is a strong program that we offer to our students on engineering education. I also highlighted the significant economic impact that our graduates certainly contribute to the economy of the Pacific Northwest region, one of the richest in the world. This economic impact is undoubtedly hard to quantify, but we can see glimpses of it in the fact that our graduates are in high demand by regional companies. Almost 90% of our seniors secure a mechanical engineering job or enroll in graduate programs before they graduate with their Bachelor of Science degree.

We are constantly focused on assessing the effectiveness of our activities in order to ensure the delivery of academic education at high standards of quality. Our department has adopted a model for pursuing and achieving of (i) educational objectives for recent graduates from our department and (ii) learning outcomes for students currently enrolled in the program.

Our program educational objectives for recent graduates who have spent 3 to 5 years on the job refer to: (1) experiencing career advancements as a result of their solid engineering knowledge and skills, (2) being able to produce engineering solutions to achieve employer, client, and other stakeholder satisfaction, (3) establishing a reputation as competent communicators through both written and verbal means, (4) developing a drive to pursue lifelong professional improvement, (5) continuing to assume extended responsibilities via collaborations, and (6) focusing on relevant societal problems such as safety, protection of the environment, ethical and legal practices, service and outreach to professional communities or society at large.

For currently enrolled undergraduate students, we adopted seven student learning outcomes, as established by the Engineering Accreditation Commission of ABET (www.abet.org). These learning outcomes require our current students being able to: (1) tackle and solve complex engineering problems, (2) produce solutions that meet a wide range of needs considering the public health, safety, and welfare, as well as global, cultural, social, environmental and economic factors, (3) communicate effectively with various audiences, (4) recognize ethical and professional responsibilities in engineering situations and make informed judgments, (5) perform engineering work effectively on a team and take on a multitude of tasks, (6) develop and conduct experiments, perform data acquisition and interpret results to draw pertinent engineering and scientific conclusions, and (7) acquire and apply new knowledge using various learning strategies.

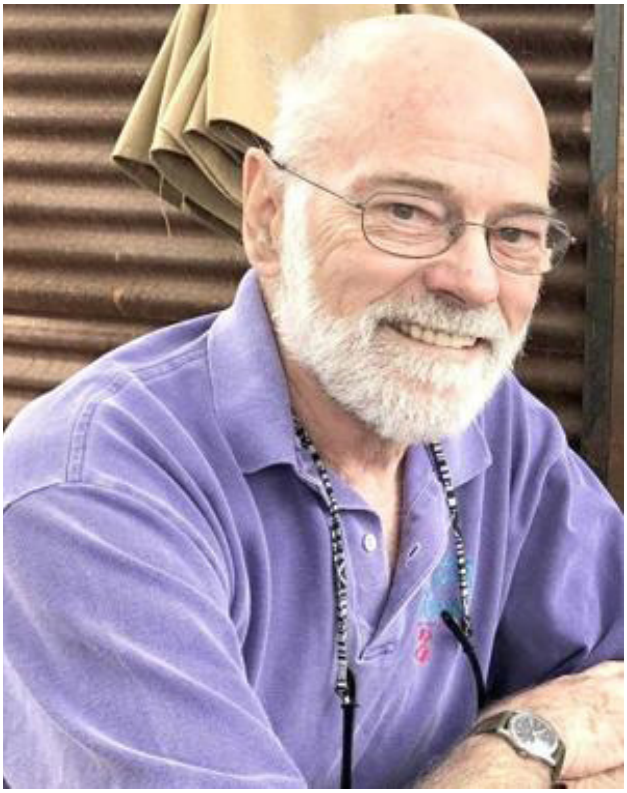
The learning outcomes that we have established for our graduate students enrolled in the Master's and Ph.D. programs focus on (1) learning and integrating knowledge to solve advanced engineering problems using a wide range of methods and tools from mathematics, science and engineering, (2) developing and exercising robust communication skills in various venues such as oral presentations in research groups, classrooms, or professional forums, and (3) building strong research skills and bringing original contributions to the field while considering real-world constraints and the impact that engineering solutions have on society at large.

Achieving the above-mentioned educational and learning outcomes requires not only sustained work on the part of our faculty members in the classroom, but also constant monitoring and assessment of student performance. Our assessment strategy is two-prong. Firstly, we perform extensive assessment work that counts toward maintaining our ABET accreditation. Our department has an excellent track record of maintaining ABET accreditation, and we will continue to prioritize it in the future. Virtually, all mechanical engineering faculty are involved in assessing and reporting student achievement levels that are used in the ABET process. We assess levels of student learning outcomes in a wide range of courses or other venues, such as Design EXPO, Fundamentals of Engineering Exams, and graduating senior surveys. Secondly, we perform significant assessment and reporting work as part of the university's Northwest Commission on Colleges and Universities (NWCCU) accreditation process. Our collected data and reports summarize conclusions and measures that we undertake periodically to improve our educational processes. We have been working closely with the Assessment and Accreditation Office at the University of Idaho to build databases and generate reports for the university's NWCCU accreditation.

Our tools, methods, and practices for assessing student learning outcomes are quite robust and time-tested. I am confident that we will continue to see a growth in the overall quality of our educational program, and thus maintain the current accreditations. As always, we are open to considering any input from the accreditation boards, the Mechanical Engineering Advisory Board, alumni and industrial entities to better tailor our educational objectives and our strategies for achieving them. In this regard, the communication with various stakeholders will continue in the future.

REMEMBERING ALAN PLACE

Written by Steve Beyerlein, Edwin Odom, and Bob Stephens



Dr. Alan Place taught in the College of Engineering at the University of Idaho from 1971-2002. Current ME professors Bob Stephens and Edwin Odom recently reflected on Alan's impact on the department. Bob always recommended that his graduate students take a class or two from Alan. Their feedback was that Alan was an outstanding, knowledgeable, and organized educator. Edwin recalled that Alan's fracture mechanics course was very popular with on campus students and equally popular through Engineering Outreach. When Edwin was requested to teach this course and showed up to teach the class, he was amazed at the Engineering Outreach enrollment, and had to explain to some disappointed students why Dr. Place was unavailable to teach the course.

Edwin also remembered the small area where Alan successfully taught crystallography, phase diagrams, and performed mechanical tests. Edwin was particularly impressed how Alan did so much with so little. This can-do, creative spirit has been passed on over the years to faculty and professional staff who have persisted in envisioning engineering education with state-of-the-art tools, leveraging funds for laboratory and design infrastructure, and applying ingenuity in creating high quality, high impact, home-grown solutions that have benefitted many generations of Vandal Engineers.

Alan served as director of the Materials Engineering and Tribology Program at the National Science Foundation from 1988-90. He was frequently called upon for his expertise in assessing the longevity, durability and structural integrity of vehicles, buildings, and crucial infrastructure.

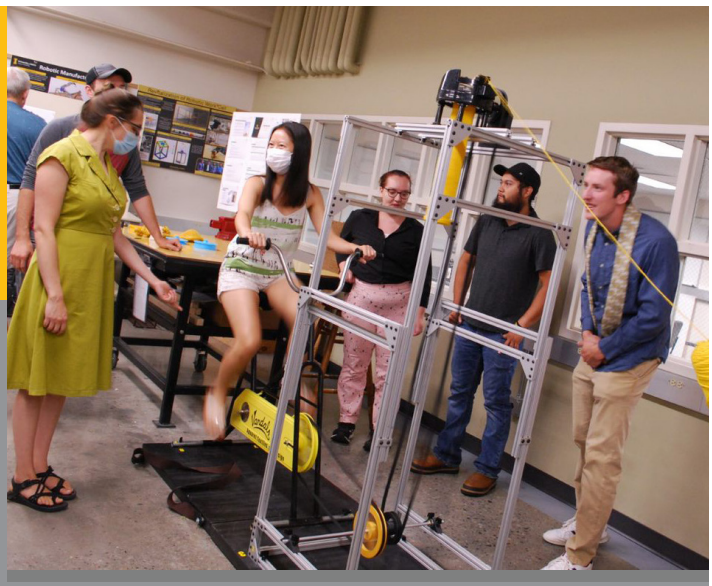
Alan was an avid outdoorsman and amateur athlete. He always took pains to make sure that no departmental meetings were scheduled during his daily mid-day running hour. Others in the department were thankful for the protected time block that this afforded for their own personal wellness. Alan's running passion led him to playing an integral role in the establishment and expansion of the Rails-to-Trails network in the Moscow-Pullman area as well as the organization of the Moscow Mountain Madness run.

SAVE THE DATE

ENGINEERING DESIGN EXPO

Friday, April 29, 2022

UIDAHO.EDU/EXPO



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