



University of Idaho
College of Engineering

**UNLEASH
THE SPIRIT
OF INNOVATION**

EXPO

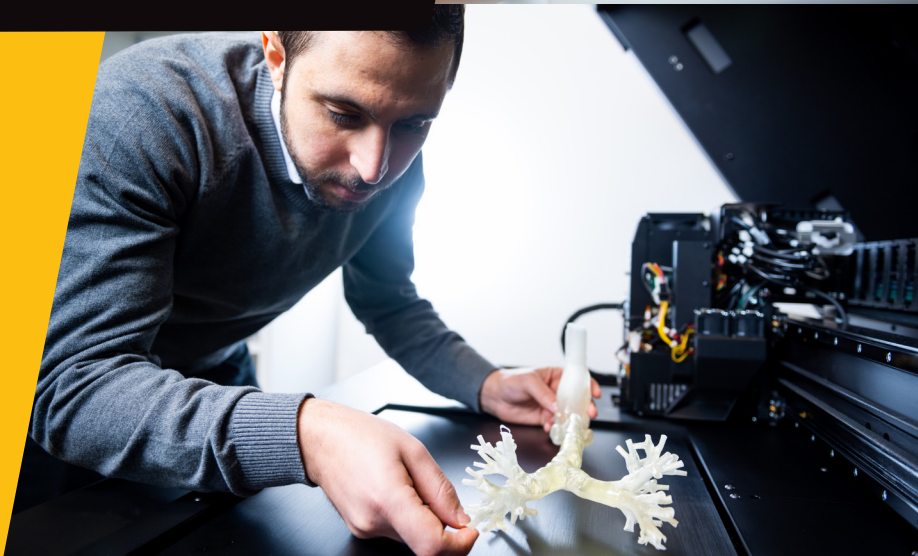
engineering ▲ design

The longest-running student engineering
innovation showcase in the Pacific Northwest

**2022 CAPSTONE
PROGRAM
GUIDE**

uidaho.edu/expo

#uidahoEXPO





Cybersecurity demands the best.

We're partnering with U of I to deliver it.

The world of cybersecurity changes fast. To protect our critical infrastructure, engineers can't just keep up—they have to stay two steps ahead.

We're working with the University of Idaho to develop a new four-year program focused on cybersecurity. Using best practices and cutting-edge research, we'll equip the next generation of engineers with the tools and knowledge they need.

Together, we're creating inherently secure technology and defining the future of cybersecurity.





WELCOME TO EXPO 2022

EXPO is a Vandal tradition of 29 years, the longest-running student engineering and technological innovation showcase in the Pacific Northwest.

Through a mix of in-person and virtual pathways, thousands across the globe experience the many ways University of Idaho students are making a difference and solving real-world problems at the annual Engineering Design EXPO.

Working in teams, senior engineering students from across disciplines present their projects from our college's Interdisciplinary Capstone Design Program, recognized by the National Academy of Engineering as one of the top seven in the nation for infusing real-world experiences into engineering education.

We are thankful for our sponsors, judges, students, faculty and staff who have worked tirelessly to bring our in-person event to fruition in one of the Moscow campus' newest engineering and architectural accomplishments, the Idaho Central Credit Union Arena. I am excited to join you to celebrate our Vandal engineers before they graduate and enter the workforce.

In addition to in-person booth presentations, all of our capstone team projects will be available to browse online. We anticipate and welcome the thousands who will visit uidaho.edu/expo to explore

projects remotely. And more than 60 judges will tune in during online technical presentations to score teams virtually this year.

In addition to our students and industry partners, we welcome the hundreds of high school and middle school students who are participating in the culmination of our EXPO: Engineering the Future design challenge. After working through lessons and projects in the classroom, students will put their skills to the test to build a self-propelled vehicle. Working in teams with no limits to their creativity, students combine their knowledge of material selection, physics, energy and other concepts to meet specific challenge objectives – just like real engineers!

The value of STEM education, hands-on experience and student development is alive and well in EXPO. These events would not be possible without the support of our industry partners and friends of the College of Engineering.

I want to thank this year's corporate sponsor Schweitzer Engineering Laboratories for their generosity and commitment to EXPO.

In addition, I want to thank all of the sponsors and partners that support EXPO activities from our Engineering the Future program to providing support to our capstone students.

Thank you to the NASA Idaho Space Grant Consortium, U of I Engineering Outreach, Exhibitor Battelle Energy Alliance, the Idaho STEM Action Center, Coeur d'Alene Tribes, CCI Speer, HP, Integra DeLamar, Idaho Power, Power Engineers, Avista Corp., Integra de Lamar and Perpetua Resources, J-U-B Engineers, Clearwater Paper and Geotek, Inc.

Whether in-person or remotely, I hope you join me in engaging with our up-and-coming Vandal engineers by commenting on team projects, asking questions and encouraging others to participate and learn more about what it means to Engineer Like a Vandal.

Sincerely

John Crepeau, Interim Dean
College of Engineering
University of Idaho

EXPLORE
EXPO ONLINE
uidaho.edu/expo

- Browse capstone projects
- View electronic posters
- Learn more about EXPO: Engineering the Future for high school and middle school students

THANK YOU, TO OUR EXPO SPONSORS!

The University of Idaho College of Engineering thanks all of our corporate and academic sponsors for their generous support of the annual Engineering Design EXPO. We value and appreciate your participation and continued commitment to engineering education.

Corporate
Presenting Sponsor:



Become a Sponsor

Planning the University of Idaho's Engineering Design EXPO is a yearlong activity.

To explore future opportunities to support EXPO, contact:

**College of Engineering
Development Team**
208-885-5888
expo@uidaho.edu

We look forward to talking with you about how you can help support this event and current and future students.

Innovation Exhibitors



Dynamic Sponsors



Tectonic Sponsors

MEET OUR JUDGES

Judges are a critical part of the Engineering Design EXPO experience for University of Idaho College of Engineering students. Interaction between students and judges creates opportunities for students to gain new insight and learn about engineering career paths and the profession in general.

Thank You for Joining Us!

Jon Adams, *Future Tundra Holdings*

John Barrutia, *DC Engineering*

Amanda Battles, *Clearwater Paper*

Matt Binsfield, *U.S. Navy*

Pat Blount, *Moscow High School*

Jacob Bonwell, *Idaho Forest Group*

Gene Bosley, *Perpetua Resources*

Bruce Bouton, *The Dragon Works*

Pietro Boyd, *Nightforce Optics*

Jim Brennan, *Slayden Constructors*

Finan Bryan, *Schweitzer Engineering Laboratories, Inc.*

Dave Christiansen, *Retired Professor of Biostatistics*

Nicholas Crabbs, *Vynyl*

Kevin Damron, *Avista Utilities*

Chris Dux, *Avista Utilities*

Chris Dyer, *POWER Engineers, Inc.*

Alyssa Ertel, *Cornell Law School*

Byron Flynn, *GE (Retired)*

Stephen Goodwin, *Schweitzer Engineering Laboratories, Inc.*

Alan Griffiths, *Self-Employed*

Kaleb Halen, *Clearwater Paper*

Dennis A. Hanson, *Hanson Industries, Inc.*

Chris Hazelton, *Coffman Engineers, Inc.*

Gary Hermann, *Retired, formerly CH2M Hill and then Velsicol Chemical Corp*

John Hjaltalin, *American Innovative Mfg.*

Scott Hodge, *Schweitzer Engineering Laboratories, Inc.*

David Hollenback, *HDT Global*

Chris Horgan, *J-U-B Engineers, Inc.*

Christopher Hyde, *University of Idaho*

Braxton Klas, *J-U-B Engineers, Inc.*

Jim Klein, *U.S. Navy*

John Kumm, *POWER Engineers, Inc.*

Cameron Leslie, *Schweitzer Engineering Laboratories, Inc.*

Tyler Marines, *Schweitzer Engineering Laboratories, Inc.*

Gary Mecham, *BEA*

Lisa Miller, *HP*

Steven Miranda, *Retired*

Kyle Morse, *Schweitzer Engineering Laboratories, Inc.*

Jared Mraz, *POWER Engineers, Inc.*

Reilly Neel, *Schweitzer Engineering Laboratories, Inc.*

Beau Nuxoll, *Idaho Forest Group*

Christian O'Bryan, *Schweitzer Engineering Laboratories, Inc.*

Caitlin Owsley, *Janicki Industries*

Brian Parsons, *Avista Utilities*

Jason Pfaff, *POWER Engineers, Inc.*

Tom Pfeiffer, *Idaho National Laboratory*

Jeremy Rice, *onsemi*

Jonathan Richards, *Schweitzer Engineering Laboratories, Inc.*

Pete Robichaud, *USDA Forest Service, Rocky Mt Research Station*

Eric Silk, *Schweitzer Engineering Laboratories, Inc.*

Jennifer Simler, *Schweitzer Engineering Laboratories, Inc.*

Alex Simon, *Boeing Commercial Airplanes*

Mark Sipe, *Coffman Engineers, Inc.*

Jacob Skaug, *Schweitzer Engineering Laboratories, Inc.*

Luis Skinner, *Schweitzer Engineering Laboratories, Inc.*

Jamison Slippy, *Kodiak Aircraft Company*

Brandon Stille, *DAHER / Kodiak Aircraft*

Todd Swanstrom, *Western Trailer Co.*

Mike Thompson, *Wagstaff, Inc.*

Dillon Turnbull, *Schweitzer Engineering Laboratories, Inc.*

Margrit von Braun, *Retired, University of Idaho*

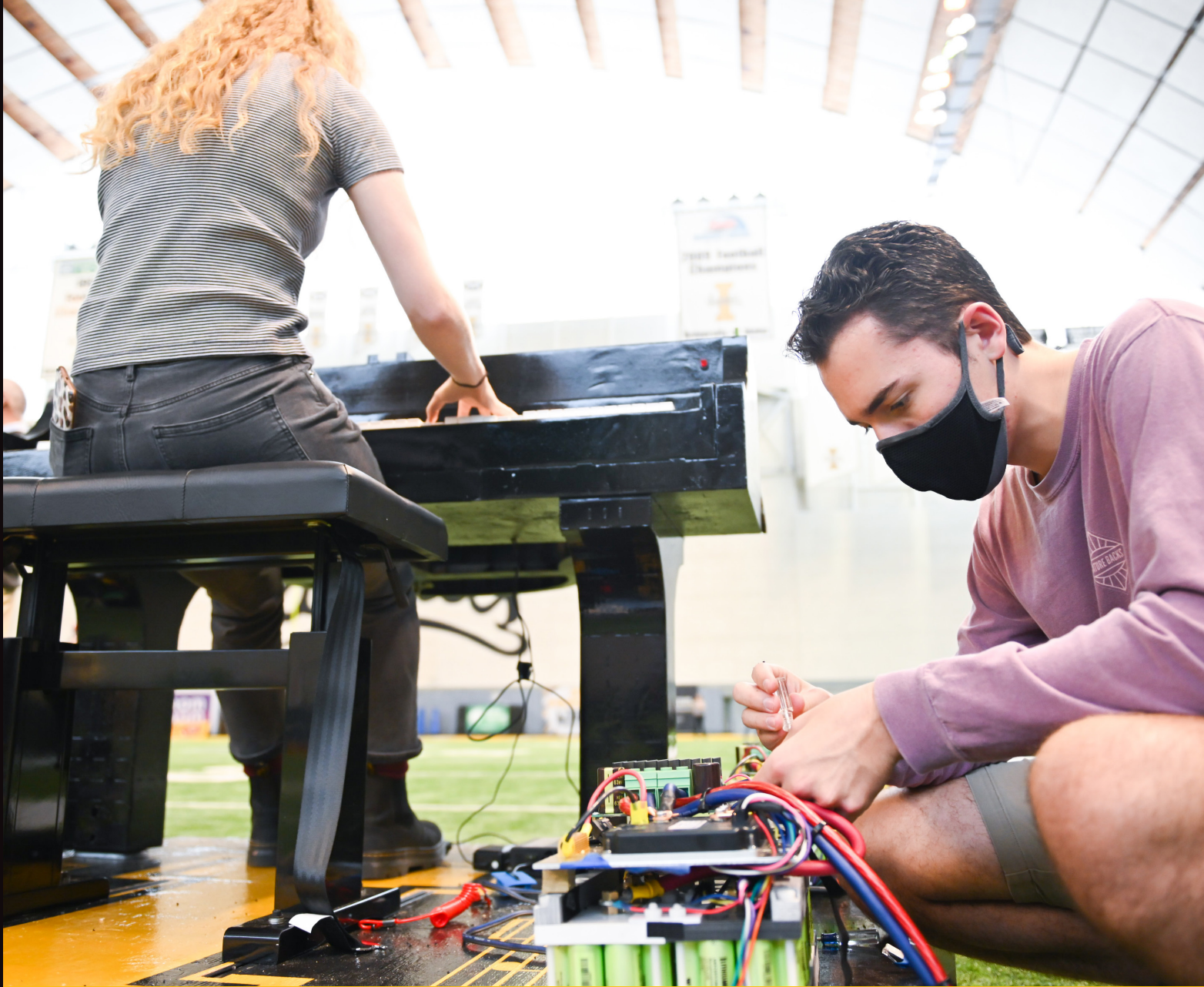
Steven Wagner, *Sony Interactive Entertainment*

David Watkins, *J-U-B Engineers, Inc.*

Jeff Williams, *Vista Outdoor*

Min Xian, *University of Idaho*





THE COLLEGE OF ENGINEERING CAPSTONE PROGRAM

Recognized by the National Academy of Engineering as one of the top seven in the nation, the University of Idaho College of Engineering Senior Capstone Design Program infuses real-world experiences into undergraduate engineering education.

Engineering students work in interdisciplinary teams on creative projects sponsored by valued industry partners, private individuals or U of I departments. Courses in the program emphasize the design process and the creation of a thoughtfully engineered, tested and validated outcome or prototype.

Our annual Engineering Design EXPO, the longest-running student engineering innovation showcase in the Pacific Northwest, is the culmination of the capstone program. Seniors present their work at EXPO through professional exhibits and technical presentations.

Biological Engineering

SHEAR STRESS BIOREACTOR TO STUDY MECHANOBIOLOGY OF STEM CELLS

Our project focuses on developing an accurate, low-cost flow shear stress bioreactor to test the effects of mechanobiology on stem cells during tenogenesis, the differentiation of stem cells into tendon cells. Better being able to test mechanobiology's effect on stem cell differentiation would allow a greater understanding of necessary conditions for tenogenesis to occur, leading to the eventual goal of being able to reliably produce replacement tendon tissue for medical purposes.

Team Members

Brian Penney - Biological Engineering
 Sonja Tollefson - Biological Engineering
 Lola Bangudu - Biological Engineering
 Nikhil Nayar - Biological Engineering

Client/Sponsor

Nathan Schiele - University of Idaho

Faculty Advisor

Russell Qualls - U of I Department of Chemical and Biological Engineering

CONTINUOUS BIOCHAR REACTOR TO IMPROVE CROP NUTRIENT AND WATER RETENTION

Due to the natural geography of the Palouse, farmers face multiple challenges with water distribution and nutrient retention in crops. Improvements can be made through the introduction of a charcoal-like substance called biochar, which has properties that allow for increased nutrient retention and water absorption in soil. The development of a small, low-cost biochar reactor would help mitigate the negative geographical effects the Palouse presents and allow farmers to increase crop yield.

Team Members

Kaitlyn Harvey - Biological Engineering
 Matthew Kraak - Biological Engineering
 Xiangchen Wei - Electrical Engineering
 Slade Castle - Mechanical Engineering
 Matthew Evans - Mechanical Engineering

Client/Sponsor

Joe Stanley - Stanley Solutions

Faculty Advisor

Russell Qualls - U of I Department of Chemical and Biological Engineering

PORTABLE BIODIESEL PRODUCTION SYSTEM

Traditional means of producing biofuels are energy inefficient, time consuming and require significant infrastructure. The goal of this project is to design and construct a portable device housing Dr. Sarah Wu's patented plasma reactor to produce useable biofuel efficiently, anywhere. By manufacturing a portable and affordable reactor system, the widespread everyday use of cheap biofuel can become an economically practical and environmentally friendly reality.

Team Members

Truman Baker - Electrical Engineering
 Andoni Bieter - Biological Engineering
 Logan Lee - Electrical Engineering
 Jacques Vos - Biological Engineering

Client/Sponsor

Sarah Wu - U of I Department of Chemical and Biological Engineering

Faculty Advisor

Russell Qualls - U of I Department of Chemical and Biological Engineering

Civil Engineering

US-95 OVER FOUR MILE CREEK

US-95 over Four Mile Creek is a bridge replacement project sponsored by Idaho Transportation Department. The current bridge, located just north of Moscow, was built in 1949 and since has experienced foundation scour and deterioration of the guardrails. By completing this project, we ensure that the local and statewide community can safely and efficiently navigate US-95 for years to come.

Team Members

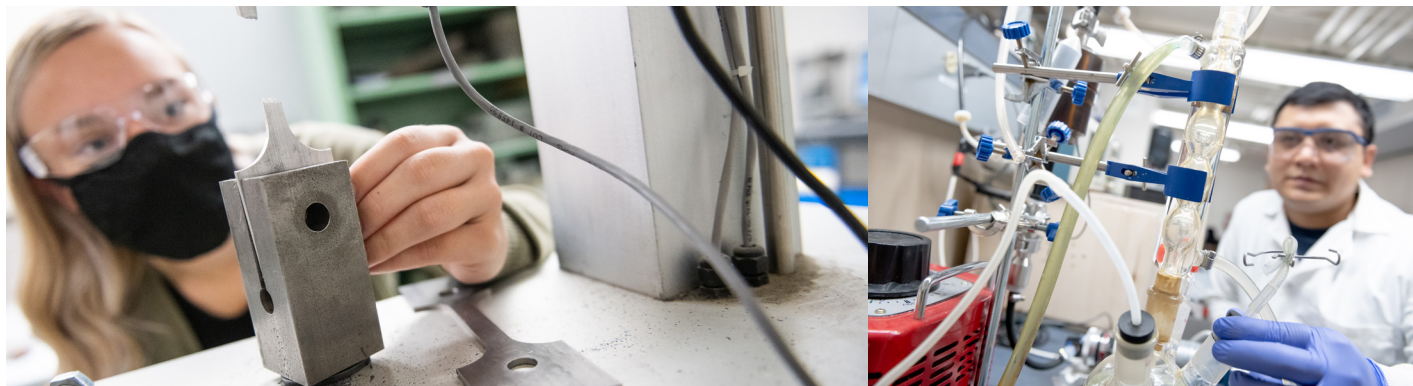
Tyler O'Toole - Civil Engineering
 Shawna Conery - Civil Engineering
 Alexander Kanet - Civil Engineering
 Will Moore - Civil Engineering
 Charles Campbell - Civil Engineering

Client/Sponsor

Shanon Murgoitio - Idaho Transportation Department

Faculty Advisor

Richard Nielsen - U of I Department of Civil and Environmental Engineering



RAPID LIGHTNING CREEK BRIDGE #5

Our project is to redesign and reconstruct Rapid Lightning Bridge #5 in Bonner County, Idaho. The current bridge needs to be replaced due to the bridge's poor substructure rating and excessive scour on the foundations.

Team Members

Olivia Overstreet - Civil Engineering
 Brian Johnson - Civil Engineering
 Nick Wells - Civil Engineering
 Marco Cervantes - Civil Engineering

Client/Sponsor

Nick McDowell - HDR

Faculty Advisor

Richard Nielsen - U of I Department of Civil and Environmental Engineering

LEWISTON WELL #7

Our team is designing multiple components of a well for the city of Lewiston, Idaho. The components include site layout, site access design, hydrological analysis, pump selection, well house design, and the transmission main design. The purpose of this project is to locate the new well and design all subsequent components to pump water from the Grande Ronde Aquifer, linking this to the current distribution system via a transmission main into the South High Reservoir.

Team Members

Audrey Schwabe - Civil Engineering
 Alexander Hymel - Civil Engineering
 Jordan Collins - Civil Engineering
 Nickolas Buonarati - Civil Engineering

Client/Sponsor

Braxton Klas - J-U-B Engineers

Faculty Advisor

Richard Nielsen - U of I Department of Civil and Environmental Engineering

CRESTVIEW DRIVE ROUNDABOUT

This is the design for a subdivision roundabout that includes a vertical and horizontal alignment, a retaining wall and stormwater conveyance system. This will provide the transportation infrastructure for 50-75 homes.

Team Members

Cole Wallen - Civil Engineering
 Hans Sween - Civil Engineering
 Braden Lorbecki - Civil Engineering
 Harrison Holley - Civil Engineering

Client/Sponsor

Jim Schmitt - 3J Consulting

Faculty Advisor

Richard Nielson - U of I Department of Civil and Environmental Engineering

CAMP SWEYOLAKAN WATER FACILITY PLAN AND UPGRADE

The purpose of this project is to create a water facility plan detailing the deficiencies of the Camp Sweyolakan drinking water system, create a program of upgrades, and design several of the updates in detail. Camp Sweyolakan is a children's summer camp on Lake Coeur d'Alene. The camp drinking water system was built in 1922 and faces many age-related issues. Additional design challenges include planning for an expansion of camp capacity and increasing the operating season of the camp.

Team Members

Willow Crites - Civil Engineering
 Criss Ward - Civil Engineering
 Brian Peck - Civil Engineering
 Benjamin McMurtry - Civil Engineering

Client/Sponsor

T-O Engineers

Faculty Advisor

Richard Nielsen - U of I Department of Civil and Environmental Engineering

FOURTH STREET AND HONEYSUCKLE AVENUE ROUNDABOUT IN HAYDEN, IDAHO

We are creating a roundabout to replace the existing intersection in order to provide better road flow, safety and quality. Additionally, roundabouts are an opportunity to add a positive aesthetic element to any area.

Team Members

Fahad Alharthi - Civil Engineering
 Ben Shaw - Civil Engineering
 Logan Prescott - Civil Engineering
 Andrew Borde - Civil Engineering

Client/Sponsor

Melissa Cleveland - Welch Comer & Associates, Inc.
 Adam Dorsey - Welchcomer

Faculty Advisor

Nielson Richard - U of I Department of Civil and Environmental Engineering

SR-248 SHOULDER RUNNING BUS

State Route 248 in Park City, Utah, experiences high levels of westbound congestion that needs to be alleviated, specifically in the morning commute. To address this, a rehabilitation project will be completed for the roadway that will include improving pedestrian safety and widening to add a westbound shoulder running bus lane from US 40 to SR-224.

Team Members

Hannah Doyle - Civil Engineering
 Grace Olson - Civil Engineering
 Miller Thurman - Civil Engineering
 Fatema Altoubi - Civil Engineering

Client/Sponsor

Rikki Sonnen - Utah Department of Transportation

Faculty Advisor

Richard Nielsen - U of I Department of Civil and Environmental Engineering

FLOATING FEATHER ROAD & BRIDGE RENOVATION

Suburb developments are in the works in Star, Idaho, and to accommodate the influx of people in the area, a section of Floating Feather Road, including a bridge, must be improved. The main objectives of this project are to increase the safety rating for future automobiles and pedestrians by adding a middle turn lane and multi-use lanes on either side of traffic flow. We will also be designing and implementing a new, larger bridge to support the additional infrastructure.

Team Members

Rylie Frei - Civil Engineering
 Ryan Frechette - Civil Engineering
 Steven Litalien - Civil Engineering
 Macjames Mizer - Civil Engineering

Client/Sponsor

Nick Saras - Horrocks Engineers

Faculty Advisor

Richard Nielsen - U of I Department of Civil and Environmental Engineering

Chemical Engineering

MODULAR DISTRIBUTED GAS-TO-LIQUIDS (GTL) SYNTHESIS

In this project, a modular system converting natural gas into longer-chain hydrocarbons was designed. The system converts methane and steam into carbon monoxide and hydrogen gas that is further reacted to products such as diesel fuel. The system was optimized to maximize profitability, operate with minimum carbon emissions and be easily deployed at oil wells.

Team Members

Jedidiah Byers - Chemical Engineering
 Adam Irons - Chemical Engineering
 John Sanchez - Chemical Engineering

Client/Sponsor

American Institute of Chemical Engineers (AIChE)

Faculty Advisor

Matthew Bernards - U of I Department of Chemical and Biological Engineering

PRESSURE SWING ADSORPTION: A FUNCTIONAL APPARATUS AND FUTURE TEACHING TOOL

Pressure swing adsorption, often abbreviated as PSA, is a common separation technique that is used to generate high-purity gas streams in industries such as manufacturing, food processing and even healthcare. Our team designed and built a PSA apparatus that will generate streams of oxygen and nitrogen for use in the chemical engineering laboratories. Further, our team completed a scale up and economic analysis of this technology for producing medical grade oxygen on-site at a medical facility.

Team Members

Sara Murphy - Chemical Engineering
 Kelty Shroyer - Chemical Engineering
 Matthew Pyle - Chemical Engineering

Client/Sponsor

U of I Department of Chemical and Biological Engineering

Faculty Advisor

Matthew Bernards - U of I Department of Chemical and Biological Engineering

CONVERSION OF CO₂ INTO VALUE-ADDED PRODUCT

With the ever-increasing push to reduce carbon dioxide emissions, the ability to convert CO₂ into a value-added product is a better option for businesses than release. In this project, a system was designed to convert CO₂ in a trickle-bed reactor. The bench scale system was also scaled in an economic study for application in a natural gas power plant.

Team Members

Peter Everett - Chemical Engineering
 Paula Mei - Chemical Engineering
 Konstantine Geranios - Chemical Engineering

Client/Sponsor

??

Faculty Advisor

Matthew Bernards - U of I Department of Chemical and Biological Engineering



ACID MINE DRAINAGE PREVENTION AT BUNKER HILL MINE

The formation of acid mine drainage at the Bunker Hill Mine, located in Kellogg, Idaho, poses a large risk to the environment. In this project, research and design of a mine cap was completed to prevent precipitation from infiltrating into the mine through the Guy Caves surface depression. An economic analysis of the construction costs was also completed to guide Bunker Hill's mitigation plan.

Team Members

Steven Knight - Chemical Engineering
Conner Wootton - Chemical Engineering
Adrian De Kruyf - Chemical Engineering

Client/Sponsor

Sam Ash - Bunker Hill Mining

Faculty Advisor

Matthew Bernards - U of I Department of Chemical and Biological Engineering

Computer Science

SENTENCE EXPANSION FOR ONLINE STORYTELLING

Transforming a sentence of a few words into a context centered paragraph can help disabled individuals with limited typing ability, allowing them to type large paragraphs in a timely manner and provide an auto-generated explanation for test questions with online learning systems.

Team Members

Jian Chang - Computer Science
Luis Lopez - Computer Science
Nathaniel Palmer - Computer Science

Client/Sponsor

Hasan Jamil - U of I Department of Computer Science

Faculty Advisor

Bruce Bolden - U of I Department of Computer Science

HUMAN MACHINE INTERFACE GESTURE SYSTEM

Many hospitals today still handle most of their medical equipment by hand. This requires that the doctors and nurses touch these devices in order to interact with the user interface, spending precious time cleaning and sanitizing each device after each use. We are creating a gesture based user interface system. The device will capture hand gestures from the user that will be able to operate medical equipment, handsfree.

Team Members

Scott Martin - Computer Science
Ezequiel Romero - Computer Science
Jenner Higgins - Computer Science

Client/Sponsor

Mitchell Butzer - Advanced Input Systems

Faculty Advisor

Bruce Bolden - U of I Department of Computer Science

ELECTRIC BLOCKS II - REALISTIC POWER SIMULATION IN MINECRAFT

Electric Blocks I brought accurate power flow simulation to Minecraft, but needed polish and quality of life improvements to be viable for its stated "educational and engineering purposes." Electric Blocks II will add improvements to the user experience, audiovisual presentation, and documentation to aid in usability.

Team Members

Greyson Biggs - Computer Science
Ryan Buckel - Computer Science
Samuel Frederickson - Computer Science

Client/Sponsor

Daniel Conte de Leon - U of I Department of Computer Science

Faculty Advisor

Bruce Bolden - U of I Department of Computer Science

VMCRAFT II - MINECRAFT VIRTUALIZATION

Along with help from a faculty member, we are developing an exciting way to increase interest and education in cybersecurity through VMCraft-II. This Minecraft mod will allow students to create a virtual computer within Minecraft and further allow educators to create virtual scenarios down the road for education. We hope to expand upon previously completed VMCraft (1) to allow for enterprise virtualization. This will allow for the ability to have many virtual machines connected to one network.

Team Members

Cade Disselkoe - Computer Science
Hunter Casteel - Computer Science
Heba Aljabrine - Computer Science

Client/Sponsor

Daniel Conte de Leon - University of Idaho

Faculty Advisor

Bruce Bolden - U of I Department of Computer Science

VIDEO GAME ENVIRONMENT FOR ARM ASSESSMENT THROUGH A ROBOTIC EXOSKELETON

The University of Idaho Assistive Robotics Lab is building an exoskeleton called BLUE SABINO to measure arm and hand function in individuals with neurological impairment (e.g. stroke). Providing clear and repeatable tasks to subjects during assessment is important and a current challenge with real-world objects. To address this, we have used the Unity Game Engine to build a configurable task environment where subjects can be presented with consistent and repeatable task guidance and feedback.

Team Members

Miguel Villanueva - Computer Science
Alex Peña - Computer Science
Dawson Hill - Computer Science

Client/Sponsor

Joel Perry - U of I Department of Mechanical Engineering

Faculty Advisor

Bruce Bolden - U of I Department of Computer Science

ONLYFACTORIES - FACTORY 4.0

Our team's project is a full stack web application that allows users to order and live track one or more disks from a remote mini factory located in the Computer Science office in Couer d'Alene. This web application can be scaled and utilized in a live factory environment for sending, tracking and managing orders. The application could also be used for different levels of education to support robotics programs.

Team Members

Keller Lawson - Computer Science
Justin Harris - Computer Science
Parker Weisel - Computer Science

Client/Sponsor

John Shovic - Industrial Robotics Program, U of I Coeur d'Alene

Faculty Advisor

John Shovic - U of I Department of Computer Science

Electrical and Computer Engineering

BAYVIEW NAVY - AUXILIARY POWER SYSTEM FOR SUBMARINE GUIDANCE NAVIGATION CONTROLLER

The Bayview Navy has an unmanned electric submarine that they use to gather sensitive acoustic data. One vital component to this is the Guidance Navigation Controller (GNC). Any failure or bump in power will restart the system, cause unnecessary down time and potentially damage the submarine if a power failure happens during testing. Our project is to redesign the power system so that the GNC is always on and does not have a power bump when switching to backup power if one power source fails.

Team Members

Dale Parkinson - Electrical Engineering
Austin Gress - Electrical Engineering
Christopher Fuentes - Mechanical Engineering
Kyle McCain - Computer Engineering
Zachary Furrow - Mechanical Engineering

Client/Sponsor

Jim Klien - U.S. Naval Surface Warfare Center, Bayview, ID

Faculty Advisor

Feng Li - U of I Department of Electrical and Computer Engineering

TANGIBLE OBJECT RECOGNITION: JOYSTICK

Most joysticks used with touchscreens are virtual and cannot provide reliable movement without looking at the joystick directly. Our project provides a way to use touchscreen controls without the need for vision. We have created a physical joystick to be placed on a touchscreen surface, combined with software to recognize the joystick's location and tilt. With no battery or plug required, this project has potential for use with medical instruments, drones, and other joystick-controlled devices.

Team Members

Sean Kennedy - Computer Science
Joel Howell - Mechanical Engineering
Joe Saccomando - Mechanical Engineering
Nicolas Espinoza - Electrical Engineering
Zachary Hammond - Computer Engineering

Client/Sponsor

Brett Harned - Advanced Input Systems
Ben Medeiros - Advanced Input Systems

Faculty Advisor

Feng Li - U of I Department of Electrical and Computer Engineering

INFRASONIC WILDFIRE DETECTION

As wildfires become an increasingly prevalent threat to homes and businesses, early detection becomes essential to avert the crisis. Since it is challenging to survey large wildlife areas with current methods, deployable infrasound sensors can supplement the effort by detecting the signatures of wildfires in their earliest stages, enabling rapid firefighter response.

Team Members

David DePaolis - Electrical Engineering
Christopher Salcido - Mechanical Engineering
Nicholas Shipp - Computer Engineering
Luke Woods - Mechanical Engineering

Client/Sponsor

Joe Stanley - Stanley Solutions

Faculty Advisor

Herbert Hess - U of I Department of Electrical and Computer Engineering



ATTITUDE DETERMINATION AND CONTROL SYSTEM FOR SMALL SATELLITE BUS

The Nano Orbital Workshop (NOW) at the NASA Ames Research Center is testing new technologies using its Technical and Educational Satellites (TES). NOW has been unable to achieve this goal due to difficulties producing attitude determination and control systems (ADCS) for its satellites. Existing ADCS options are costly and prone to long lead-times, limiting the rate at which NOW can launch TESs. Team Attitude Adjustment will develop a simple and affordable alternative to current ADCS solutions.

Team Members

Connor Braase - Electrical Engineering
 Christopher Wiegert - Electrical Engineering
 Kristie Olds - Computer Science
 Garrett Wells - Computer Science
 Parker Piedmont - Computer Engineering
 Sebastian Garcia - Mechanical Engineering
 Malachi Mooney-Rivkin - Mechanical Engineering

Client/Sponsor

Marcus Murbach - NASA Ames Research Center
 AveryBrock - NASA AMES

Faculty Advisor

Feng Li - U of I Department of Electrical and Computer Engineering

DEBALING AGRICULTURAL MATERIALS FOR BIOPROCESSING INDUSTRIES, IMPLEMENTING AN ANTI-CLOGGING ALGORITHM

Raw agricultural materials are used in various applications, such as biofuels and bioplastics. These materials are shipped in bales and must be turned back into the loose material. Current machines can debale but produce too many fines. Our team is continuing work on the debaler prototype, giving it the potential to debale various types of agricultural materials autonomously, efficiently, without producing fines. Once completed, this prototype can be scaled to fit larger applications.

Team Members

Ahmed Almahie - Mechanical Engineering
 Austin Crofoot - Electrical Engineering
 Kevin Russell - Electrical Engineering

Client/Sponsor

David Lanning - Forest Concepts, LLC

Faculty Advisor

Feng Li - U of I Department of Electrical and Computer Engineering

DESIGN OF ENERGY MANAGEMENT SYSTEM SIMULATION EXERCISES

This is a distributed real-time control system where controller and operator receive measurement data from around substations in the power system. The autonomous functions and the operator can take actions such as changing generator set points, switching capacitor banks, possibly shedding load. This will help students learn about what actions operators can take to resolve problems and methods for improving power system reliability and resilience.

Team Members

Siyi Song - Electrical Engineering
 Yuchen Lin - Electrical Engineering
 Zhichao Zhang - Electrical Engineering
 Zudo Wang - Electrical Engineering

Client/Sponsor

Brian Johnson - University of Idaho

Faculty Advisor

Feng Li - U of I Department of Electrical and Computer Engineering

Mechanical Engineering

NASA CRYOGENIC TENSILE TESTER

We are making a low cost tensile tester that operates at low temperatures. With assistance from NASA, we aim to allow the University of Idaho to test materials at cryogenic temperatures. The importance of our project can be expressed through imitating the conditions experienced by materials used for rockets and satellites.

Team Members

Daniel Cabrera - Mechanical Engineering
 Louie Forman - Mechanical Engineering
 Kevin Sikes - Electrical Engineering
 Thomas Gibson - Mechanical Engineering

Client/Sponsor

NASA Idaho Space Grant Consortium

Faculty Advisor

Michael Maughan - U of I Department of Mechanical Engineering

NUCLEAR FUEL PIN JACKET PRODUCTION

Nuclear energy is a viable solution to produce clean energy. The Versatile Test Reactor is a sodium-cooled fast nuclear reactor that will help supply the world with clean energy. Currently, no system exists to produce sodium protected fuel rods for use at a U.S. Department of Energy national laboratory. This project is an automated system that extrudes sodium wire into a fuel pin jacket to protect the internal systems from oxygen in the environment. Our objective is to show proof of concept to load 300 pins per week.

Team Members

Julia Bean - Materials Science and Engineering
 Alexander Chambers - Mechanical Engineering
 Jadzia Graves - Mechanical Engineering/Materials Science and Engineering
 Ryan Oliver - Mechanical Engineering
 Maxwell Vavricka - Materials Science and Engineering

Client/Sponsor

Randall Fielding - Idaho National Laboratory

Faculty Advisor

Michael Maughan - U of I Department of Mechanical Engineering

SINGLE LEVER TILT AND TELESCOPE ADJUSTMENT FOR FORKLIFT STEERING COLUMN

A sizeable amount of time operating a forklift is sunk into adjusting the steering column between users as there are often several operators per machine. Adjusting the column position using the two existing levers only takes a few seconds, however that time adds up. By condensing the two adjustment levers into a single motion, downtime is reduced. Our goal is to create a more robust version of the technology found in passenger vehicles that can be installed into Hyster-Yale forklifts.

Team Members

Marcus Johnson - Mechanical Engineering
Andrew Ferrero - Mechanical Engineering
Katie Ward - Mechanical Engineering

Client/Sponsor

Samuel Weiss - Hyster-Yale Material Handling

Faculty Advisor

Matthew Swenson - U of I Department of Mechanical Engineering

SEL PACKAGE DROPPING MACHINE

SEL performs drop tests on packages to ensure they can withstand shipping. These tests are currently done by hand. This process is physically strenuous, ergonomically challenging and introduces the risk of injury to the operator. This method also adds variability in testing, including differences in timing during a two-person drop. Equipment capable of providing a stable and accurate test would improve performance and reduce the labor involved with transportation

Team Members

Lindsay Guthrie - Mechanical Engineering
Zane Holliday - Mechanical Engineering
Andrew Stucker - Mechanical Engineering
Sophia Wieber - Mechanical Engineering

Client/Sponsor

Jonathan Richards - Schweitzer Engineering Laboratories
Kristina Scrimshaw - Schweitzer Engineering Laboratories

Faculty Advisor

Matthew Swenson - U of I Department of Mechanical Engineering

TWO STROKE ENGINE EMISSIONS AND CALIBRATION

We've worked to modify an existing snowmobile in order to meet specific sound and emission requirements outlined in the national SAE Clean Snowmobile Competition. Engine calibration, exhaust modification and aftertreatment, test cell updates and computer modeling are all utilized in order to reach our goal. This carries over into the automotive world as we attempt to continue improvement in order to meet the societal demand for cleaner and more efficient vehicles without limiting rideability or rider enjoyment.

Team Members

Garrett Potts - Mechanical Engineering
Lukas Willits - Mechanical Engineering

Client/Sponsor

U of I Department of Mechanical Engineering

Faculty Advisor

Steve Beyerlein - U of I Department of Mechanical Engineering

POP 'N LOCK ROBOTIC ARM

Manufacturing processes are starting to incorporate more robotic equipment that increases productivity. Currently, these robots cannot easily be reconfigured once they are designed. Our quick attach robotic arm linkage will change this and allow for industrial robots to be quickly reconfigured to serve other purposes. Our goal is to hold the design integrity while allowing for quick adaptations.

Team Members

Jesse Ebert - Mechanical Engineering
Levi Gallegos - Mechanical Engineering
Nick Lee - Mechanical Engineering
Justin Wick - Mechanical Engineering

Client/Sponsor

Gabe Riggs - Bastian Solutions

Faculty Advisor

Joel Perry - U of I Department of Mechanical Engineering

FIXTURE FOR MEASURING BACKLASH IN RIFLE SCOPES

Our team has worked with Nightforce Optics in prototyping a lead screw adjustment mechanism for verifying the accuracy of turret components used in rifle scopes. By incorporating this tool in the manufacturing process, more accurate bullet trajectories can be realized by hunters, service men and women, and law enforcement officers.

Team Members

Trent Hunter - Mechanical Engineering
Tanner Abbott - Mechanical Engineering
Sarah Rochford - Mechanical Engineering
Paul Riebe - Mechanical Engineering

Client/Sponsor

Jake Elliott - Nightforce Optics
CoreyRunia - Nightforce Optics

Faculty Advisor

Steven Beyerlein - U of I Department of Mechanical Engineering

TRACKED FORESTRY RESEARCH ROBOT

Forests in the Northwest are filled with small, low-diameter trees and brush that are the perfect fuel for forest fires. Using machinery is the best way to clear this brush and reduce wildfire risk, but it has economic drawbacks. This project addresses that issue by having a small form-factor, electric drive, and potential for future independent operation. We are creating a small, remote control, potentially self-driven, machine for better brush clearing. This will ease forest management.

Team Members

Adam Palmer-Handley - Mechanical Engineering
Matt Farkas - Mechanical Engineering
Ryan Wagner - Computer Science
Micheal Bean - Computer Science
Hayden Willingham - Electrical Engineering
Ethan Reeder - Electrical Engineering

Client/Sponsor

Eric Wolbrecht - U of I Department of Mechanical Engineering
John Canning - University of Idaho, College of Engineering

Faculty Advisor

Matthew Swenson - U of I Department of Mechanical Engineering

FIRE-RESISTANT WIND TUNNEL

Wildfires are a significant and growing cause of public devastation. We are designing and testing a fire-resistant wind tunnel to simulate embers dispersed through a forest fire. This wind tunnel will need to withstand extreme heat, and results from these experiments will help us better understand how wildfires spread to help save lives and property.

Team Members

Quinn Barton - Mechanical Engineering
 Wil Jansen van Beek - Mechanical Engineering
 Ty George - Mechanical Engineering
 Nicholas Pancheri - Biological Engineering

Client/Sponsor

Alistair Smith - U of I College of Natural Resources
 DouglasHardman - UI College of Natural Resources

Faculty Advisor

Michael Maughan - U of I Department of Mechanical Engineering

NON-DESTRUCTIVE INSPECTION OF ELECTRONICS USING COMPUTED TOMOGRAPHY (CT)

How important is electricity? Our power grid has the responsibility of ensuring our businesses and homes are reliably heated, cooled, and lit. The electronics that run the grid are designed with low failure rates, but defects can still appear. These defects are difficult to detect without destroying the product.

Schweitzer Engineering Laboratories (SEL) has sponsored our team to use X-ray images to allow non-destructive inspection of their electronics.

Team Members

Wesley Gates - Mechanical Engineering
 Dustin Taylor - Mechanical Engineering
 Tiana Black - Mechanical Engineering
 Cory Summers - Computer Science
 Davey Anguiano - Computer Science

Client/Sponsor

Alex Olson - Schweitzer Engineering Laboratories
 Sally Mei - Schweitzer Engineering Laboratories

Faculty Advisor

Michael Maughan - U of I Department of Mechanical Engineering

PERFORMANCE ENHANCEMENT AND MODERNIZATION OF MILITARY ELECTRIC VEHICLE CONVERSION

The University of Idaho received a declassified hybrid-electric military vehicle that will become a campus attraction to display the excellence of Vandal engineering. We are repurposing the vehicle by converting the hybrid-electric system to fully-electric, improving the electrical systems, altering the cabin, repairing the chassis and extensive design work.

Team Members

Caitlin Suire - Electrical Engineering
 Chance Foss - Electrical Engineering
 Connor Parks - Mechanical Engineering
 Aero Doty - Mechanical Engineering
 Cole Kissler - Mechanical Engineering

Client/Sponsor

Herbert Hess - U of I Department of Electrical and Computer Engineering

Faculty Advisor

Matthew Swenson - U of I Department of Mechanical Engineering

LEG EXOSKELETON FOR MULTIPLE SCLEROSIS WALKING ASSISTANCE

Currently, most walking assistance devices for those with limited leg strength/mobility provide full-propulsion, which replaces the use of remaining muscle in the leg and can lead to muscle degeneration. The goal of this project is to create a device to help the user walk across flat ground, without replacing use of their own muscles. This project has the potential to improve our client's quality of life and could advance the technology of walking devices for a range of disabilities/conditions.

Team Members

Alexandra Cunningham - Biological Engineering
 Parker Daniel - Mechanical Engineering
 Melissa Huchet - Biological Engineering
 Devin Sheehan - Biological Engineering
 Rachel Stanley - Mechanical Engineering

Client/Sponsor

Dean and Cindy Haagenson Mechanical Engineering Endowed Professorship
 KevinRhodes

Faculty Advisor

Joel Perry - U of I Department of Mechanical Engineering

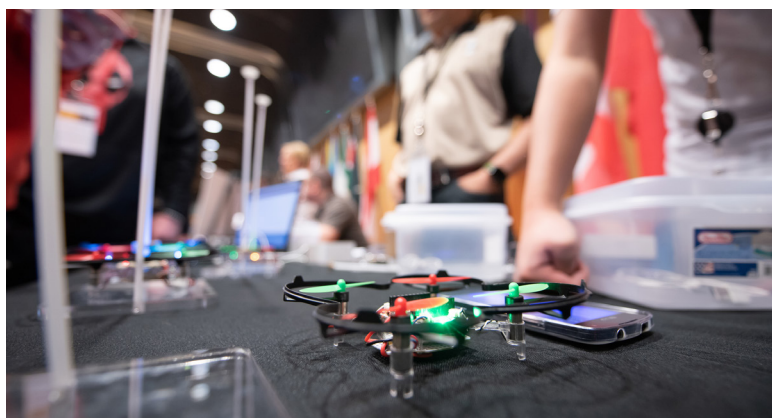


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- Introduce students to best practices in industry for design and manufacturing.

Projects for the year are identified, scoped and budgeted by Aug. 1.



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Young inventors grades 1st through 8th are awarded scholarships to attend the University of Idaho College of Engineering based on competition projects. Learn more at inventidaho.com.



Arielle Levi

"The Human Surge Protector"



Adley Garwick

"Poultry Protector"



Branson Howard

"Sidewalk Sweeper"

2022 EXPO ORGANIZING COMMITTEE

For questions related to sponsorship, K-12 outreach and other ways you can get involved, please email expo@uidaho.edu or contact an individual representative below.

Event Management

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- Elizabeth Marshall
Special Events Manager
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- Aarika Dobbins, Management Assistant
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- Maggie Scott, Associate Director of Development
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- Dan Cordon, Capstone Instructor
Clinical Faculty Assistant Professor, Mechanical Engineering
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EXPO Extended Experience

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- Alexis Turner, Marketing & Communications Manager
alexisst@uidaho.edu



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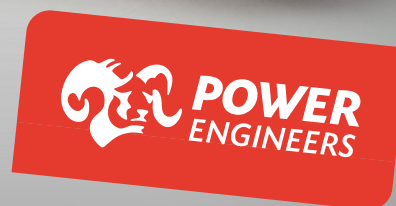
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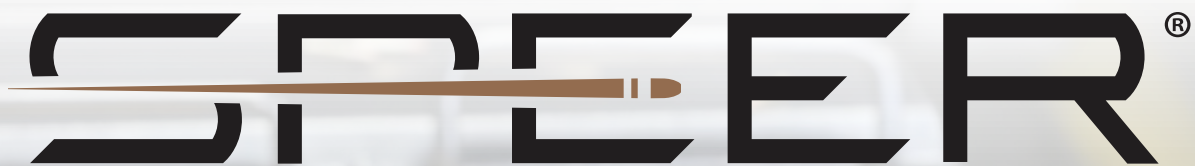


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The CCI logo is rendered in a bold, red, sans-serif font. The letters 'C', 'C', and 'I' are connected, with the 'I' having a distinctive slanted top. A registered trademark symbol (®) is located at the bottom right of the 'I'.

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The Speer logo is in a black, stylized, blocky font. A horizontal line with a small arrowhead pointing to the right cuts through the middle of the letters 'P', 'E', and 'E'. A registered trademark symbol (®) is at the top right of the 'R'.

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The background of the advertisement is a close-up photograph of several metal trays filled with brass ammunition casing. The trays are arranged in rows, and the casing is piled high, creating a textured, golden-brown surface. The lighting is bright, highlighting the metallic sheen of the brass.

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– Joshua O.

M. Engr., Mechanical Engineering

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– Mattie Cupps

M. Engr., Engineering Management/Micron

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