



University of Idaho

College of Engineering



**EXPO**  
engineering ▲ design

**3 YEARS**

*of Unstoppable  
Innovation*



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

# 2023 Program Guide



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#uidahoEXPO



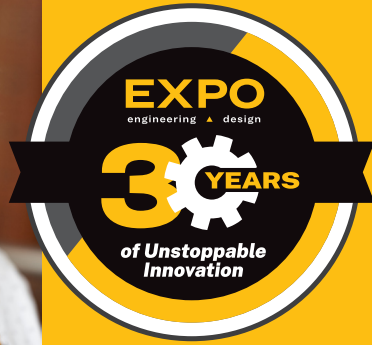


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# WELCOME TO EXPO 2023

*30 Years of Unstoppable Innovation*

Celebrating 30 years of unstoppable innovation, University of Idaho College of Engineering's annual Engineering Design EXPO is the longest-running student engineering and technological innovation showcase in the Pacific Northwest.

For three decades we have listened to our industry partners and business leaders, educating students with skillsets that align with emerging technologies that are reshaping the workplace and job market. You'll see many examples of these skillsets as you browse projects today.

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. EXPO is the final culminating event before our students graduate and join the workforce.

High school students attend EXPO each year to explore projects that push the boundaries of science and technology through our Engineering the Future program. Students gain

a better sense of what it's like to be an engineering student at U of I by meeting current students and faculty members, and exploring the many hands-on and research opportunities available to undergraduates at U of I.

Industry leaders from across the region attend and help judge the projects presented at EXPO, giving ample opportunity for students to meet and interact with industry leaders who are looking to hire highly-skilled additions to their teams.

Over the years, EXPO has grown in significance, bolstering our educational process and our students' development. But EXPO is not possible without the support of our industry partners and friends of the College of Engineering. We depend on your generous support to produce this quality event.

I want to thank this year's corporate and academic presenting sponsors, Schweitzer Engineering Laboratories and Engineering Outreach at the University of Idaho, 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 meals for our capstone students.

Thank you to Idaho National Laboratory, Idaho STEM Action Center, Avista Corp., Geotek, Inc., HP, Inc., Idaho Power, Integra DeLamar, J-U-B Engineers, POWER Foundation/POWER Engineers, Vista Outdoor/CCI Speer, Intermountain Gas Company and KPFF.

As you visit EXPO, please engage with our students and ask them about their projects and designs and the future they hope to create as a Vandal engineer.

What will the next 30 years hold? Time will tell, and our college will continue to develop engineering professionals uniquely equipped to tackle the toughest challenges facing our society.

Sincerely,

**Suzanna Long, Ph.D., P.E., CPEM, F.ASEM, F.IISE**  
*Dean, College of Engineering*

**EXPLORE**  
**EXPO ONLINE**  
[uidaho.edu/expo](http://uidaho.edu/expo)

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

# THANK YOU, 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**



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# 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 - *Engineered Solar Systems*

Jamin Ankney - *Gray & Osborne, Inc. Consulting Engineers*

Peter Baran - *Design Magnitude Idaho*

John Barrutia - *DC Engineering*

Amanda Battles - *Clearwater Paper*

Cory Baune - *J-U-B ENGINEERS, Inc.*

Pat Blount - *Moscow High School*

Bruce Bouton - *Retired*

Jim Brennan - *MWH/Slayden Constructors*

David Buehler - *Schweitzer Engineering Laboratories, Inc.*

Sumanth Reddy Chintala - *Itron, Inc.*

David Christiansen - *Retired*

Shawna Conery - *J-U-B Engineers, Inc.*

Nick Crabbs - *Vynyl*

Mattie Cupps - *Micron Technology*

Jason Dearien - *Schweitzer Engineering Laboratories, Inc.*

Michael Delles - *Retired*

Chris Dux - *Avista Utilities*

Chris Dyer - *POWER Engineers, Inc.*

Holly Eilers - *David Evans and Associates*

Byron Flynn - *GE Renewable Energy (Retired)*

Alan Griffiths - *Retired*

Zara Guzman - *Gray & Osborne, Inc. Consulting Engineers*

Gene Hamacher - *University of Idaho - TechHelp*

Alexander Hanson - *RogueTally*

Eric Hasenoehrl - *Keltic Engineering, Inc.*

Gary Hermann - *Velsicol Chemical Corp and CH2M Hill*

Connor Hill - *Element 1 Corp.*

David Hollenback - *HDT Global*

Paul Huber - *The Boeing Company*

Christopher Hyde - *University of Idaho*

Lundyn Jared - *University of Idaho*

Nathaniel Jones - *Schweitzer Engineering Laboratories, Inc.*

Victoria Kampfer - *PSNS & IMF*

Jesse Kappmeyer - *Idaho National Lab/ Battelle Energy Alliance*

Joseph Keegan - *The Boeing Company*

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

John Kumm - *POWER Engineers, Inc.*

Kiersten Lee - *MWH*

Sergey Lepskiy - *J.R. Simplot*

Zach Lipple - *BorgWarner*

Ben Marek - *AIRE Whitewater*

Tyler Marines - *Schweitzer Engineering Laboratories, Inc.*

Ken Mays - *The Boeing Company*

Andrew McGowan - *Integra Resources - DeLamar Mining Company*

Terry McHugh - *Evonik*

Gary Mecham - *BEA*

Manan Mehta - *Schweitzer Engineering Laboratories, Inc.*

Sally Mei - *Schweitzer Engineering Laboratories, Inc.*

Michael Melder - *PBS Engineering and Environmental*

Justin Miller - *HP Inc.*

Brian Miner - *Rohinni*

Steven Miranda - *Retired*

Amin Mirkouei - *University of Idaho*

Macjames Mizer - *Ardurra/TO Engineers*

Thomas Moore - *Self*

Nadine Morasci - *Astronics AES*

Shane Needham - *Veloxity Labs*

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

Lee Ostrom - *University of Idaho*

Tom Pfeiffer - *Idaho National Lab/ Battelle Energy Alliance*

Christian Pickens - *Clearwater Paper*

Carol Pochardt - *Windval Technologies*

Jonathan Richards - *Schweitzer Engineering Laboratories, Inc.*

Paul Riebe - *Idaho Forest Group*

Kierra Russell - *Clearwater Paper*

Eric Silk - *University of Illinois Urbana-Champaign*

Jennifer Simler - *Schweitzer Engineering Laboratories, Inc.*

Alex Simon - *The Boeing Company*

Mark Sipe - *Coffman Engineers, Inc.*

Jacob Skaug - *Schweitzer Engineering Laboratories, Inc.*

Howard Skidmore - *POWER Engineers, Inc.*

Josh Starkey - *The Boeing Company*

Tammy St. John-Tesky - *University of Idaho*

Eric Stubbs - *Micron Technology*

Scott Sumner - *SynTier Engineering, Inc.*

Todd Swanstrom - *Western Trailer Co.*

Nicholas Taylor - *AECOM*

Arthur Thomas - *Jacobs Engineering, Inc.*

Steven Wagner - *PlayStation*

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

Jan Welch - *Stapley Engineering*

Michael Williams - *Verdis*

Jeff Williams - *Vista Outdoor*

Hattie Zobott - *Ardurra*

Ryan Zrno - *JST*





## 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.



## STEM CELL TENDON BIOREACTOR

Cells in our tendons experience stresses when we walk, run, and perform any mechanical movement. The shear stresses these tendon cells experience has the potential to impact their biological response. To study this response, we designed a bioreactor system that can apply well-defined and controlled levels of shear stress to cells in cell culture.

### Team Members

Gage Nardi - Computer Science  
Rui Bao - Computer Science  
Guinevere Richmond - Biological Engineering  
David Reetz - Biological Engineering  
Nicholas Anderson - Biological Engineering

### Client/Sponsor

Nathan Shiele - U of I Department of Chemical and Biological Engineering

### Faculty Advisor

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

## EVALUATION OF BIOFILM RESISTANT COATINGS FOR SPACECRAFT WATER SYSTEMS

Biofilm mitigation in spacecraft water systems is crucial for space exploration. The project goal is to create an experimental apparatus to test the viability of polymer coatings that will reduce bacterial adhesion and biofilm formation of two bacteria strains found at concerning levels in the International Space Station. The project will be sent to the ISS so experimentation can occur in microgravity. It will then be sent back to Earth to evaluate the success of biofilm formation resistance.

### Team Members

Abraham Brown - Mechanical Engineering  
Devan Naes - Chemical Engineering  
Gabe Nelson - Materials Science  
Lindsey Stachofsky - Biological Engineering  
Melissa Phung - Biological Engineering  
Sam Kreslins - Mechanical Engineering  
Taylor Booker - Biological Engineering

### Client/Sponsor

Matthew Bernards - NASA EPSCoR

### Faculty Advisor

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

## 3D PRINTED FLEXIBLE SPINE MODEL FOR DRUG DELIVERY TO THE BRAIN

This project aimed to better understand how drugs injected in the lumbar area of the spine travel through the cerebrospinal fluid via a 3D printed flexible spinal model. By studying the simulated fluid flow, this can assist healthcare workers in understanding and developing safer drug delivery techniques for future procedures.

### Team Members

Sydney Inman - Biological Engineering  
Bruno Casino Remondo - Biological Engineering  
Anne Carper - Biological Engineering

### Client/Sponsor

Dev Shrestha - U of I Department of Chemical and Biological Engineering

### Faculty Advisor

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

## MEASURING NERVE RESPONSE IN EARTHWORMS FROM MINIMAL ELECTRICAL STIMULUS

Neurobiology has historically been a difficult subject to teach and provide hands-on labs for. Action potentials are the body's way of creating electrical signal through the nerves that acts as the starting point that results in muscle contraction. Live earthworms will be anesthetized and electrically stimulated to generate action potentials. These signals will be live time monitored to evaluate response and system accuracy. We will also be creating a lab simulation based on live results.

### Team Members

Honeyville Boiser - Biological Engineering  
Lauren Graves - Biological Engineering  
Alyssa Hansten - Biological Engineering

### Client/Sponsor

Dev Shrestha - U of I Department of Chemical and Biological Engineering

### Faculty Advisor

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



## Chemical Engineering

### PLASTIC WASTE TO FUEL: RECYCLING IN BALI

Finding a way to recycle used plastic would improve waste and help the environment drastically. Our team was tasked with developing a part of a process that could take recycled plastic and turn it into usable fuel. This process separated and purified incoming treated plastic, finding uses for the by-products. The team also reviewed the recycling collection process for improvements in Indonesia, a country struggling with plastic pollution, to increase recycling involvement among the public.

#### Team Members

Isaac Blake - Chemical Engineering  
Aaron Law - Chemical Engineering  
Rahul Bhusal - Chemical Engineering  
Juhung Lee - 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

### PYROLYSIS OIL PURIFICATION DESIGN: CLOSING THE PLASTIC ECONOMY

In this project, improvements to the plastic recycling collection and sorting system for Bali, Indonesia, were recommended to improve throughput, affordability, and quality. Also, a purification unit was simulated and designed to separate fractions of the plastic recycling products for reuse. This system was designed to maximize economic benefit and efficiency to assist Global Petrochemicals in its aim to reduce waste during plastic recycling.

#### Team Members

Joshua Anderson - Chemical Engineering  
Jonathan Bosse - Chemical Engineering  
Nick Rowe - 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



## OPTIMIZATION OF THE MIXSTIX PLATFORM

The Mixstix platform is a product that allows anyone to send a simple science experiment into space. The current Mixstix platform is going through a redesign in order to make it less expensive, easier to use, and to decrease the chances of platform operational errors. New tubing, clamps, end caps, and sealing approaches will undergo testing in order to find the best design to meet the customer needs for the Mixstix experiment platform.

#### Team Members

Alexis Dunham - Chemical Engineering  
Sam Johnson - Chemical Engineering

#### Client/Sponsor

NanoRacks

#### Faculty Advisor

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

### PRESSURE SWING ADSORPTION: SEPARATION OF NITROGEN AND OXYGEN FROM AIR

Pressure Swing Adsorption, PSA, is a common separation technique that is used to produce high-purity gas product streams that can be used in a variety of industrial applications. The PSA design team designed and assembled a fully functional bench-scale PSA that produces streams of oxygen and nitrogen. This bench-scale system will serve as a teaching aid for the future senior chemical engineering laboratories. Our team completed scale up and economic analysis for use at an on-site medical center.

#### Team Members

Jourdan Allen - Chemical Engineering  
Jacob Snow - 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

## Civil Engineering

### NEW OFFICE BUILDING FOR GENERAL CONTRACTOR - KAPOLEI, HAWAII

A California-based general contractor, Tri State General Contractors, is seeking to expand their operations by adding a new office building with attached construction warehouse/shop space in Kapolei, Hawaii. Tri State's new building is planned to be approximately 23,815 square feet, and will consist of finished office space, a storage mezzanine over the offices, and a large open shop area.

#### Team Members

Austin Emerick - Civil Engineering  
John Taylor - Civil Engineering  
Devin Steed - Civil Engineering  
Parker Watson - Civil Engineering

#### Client/Sponsor

Garrett Davis - Tamarack Grove Engineering  
Derek Peck - Tamarack Grove Engineering

#### Faculty Advisor

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



## NEZPERCE SEWER REUSE SYSTEM

The City of Nezperce will be implementing a sewer reuse system, where treated sewerage from the existing lagoon system treatment plant is pumped via new lift station(s) to new storage pond(s), including any and all control structures, and then applied to fields via irrigation, which will also require lift station(s).

### Team Members

Sarah Cordier - Civil Engineering  
Kenneth Madsen - Civil Engineering  
Nathyn Maller - Civil Engineering  
Luke Rutherford - Civil Engineering

### Client/Sponsor

Braxton Klas - J-U-B Engineering, Inc.  
City of Nezperce

### Faculty Advisor

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

## SH-3 POTLATCH RIVER BRIDGE REPLACEMENT

The Potlatch Bridge Replacement is important because it expands the number of roads that oversized trucks can use. The original bridge was built in 1955. By increasing the road network, it will allow the transportation of goods to happen more efficiently.

### Team Members

Anthony Davis - Civil Engineering  
Matthew Thompson - Civil Engineering  
Peter Osterberg - Civil Engineering  
Zixiang Yu - Civil Engineering

### Client/Sponsor

Shanon Murgoitio - Idaho Transportation Department

### Faculty Advisor

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

## OREANA DAM REPLACEMENT

In this project our team is designing a small dam along a creek in Oreana Idaho to create a pond that will be used for irrigation and attracting water fowl.

### Team Members

Brenden Jack - Civil Engineering  
Mitchell Langland - Civil Engineering  
Jacob Smith - Civil Engineering  
Jacob Wisshack - Civil Engineering

### Client/Sponsor

Luke Landriani - Geotek  
HattieZobott - TO Engineers

### Faculty Advisor

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

## KOOTENAI COUNTY INTEGRATED CLINIC

The project focuses on a new integrated medical clinic near the Spokane River in Post Falls, Idaho. This medical clinic is being designed to support members of the community with primary care medical needs and to provide space for future growth as the city develops. The entire first level of the clinic will be hosting all the examination rooms, nursing stations, and patient care. The second level will be used as future client space and for storage of all the clinic's needs.

### Team Members

Anna Young - Civil Engineering  
Philip Lohman - Civil Engineering  
Xinyi Li - Civil Engineering  
Clint Ponozzo - Civil Engineering

### Client/Sponsor

Lucas Coutinho - Vista Outdoor  
ChaneyWood - KPFF

### Faculty Advisor

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

## LACROSSE AVE INTERSECTION AND EXPANSION

This project is designing a much needed route to go into the Riverstone Development area, which has been seeing an increase in population and use. The team is also designing an access point for the popular Centennial Trailhead which is located next to the expanded road.

### Team Members

Jarod Shannon - Civil Engineering  
Ethan Hardt - Civil Engineering  
Shaunita Cable - Civil Engineering  
Joel Gradin - Civil Engineering

### Client/Sponsor

Melissa Cleveland - Welch Comer Engineers  
JackGriffing - Welch Comer Engineers

### Faculty Advisor

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



## SOLIDS MANAGEMENT IMPROVEMENT PROJECT – ANAEROBIC DIGESTER SEEDING WITH HYDROLYZED SLUDGE

The Trinity River Authority Central Regional Wastewater System is upgrading their treatment process to thermophilic anaerobic digestion to treat their sludge. This upgrade will allow the plant to generate Class A biosolids and produce methane which can be captured and used to produce energy to offset energy costs for the facility. We will be in charge of transporting the sludge from Blue Plains WWTP in D.C., designing all temporary systems, and properly seeding the new anaerobic digester.

### Team Members

Edward Black - Civil Engineering  
Brandon Boyd - Civil Engineering  
Noah Throm - Civil Engineering  
Harrison Bashaw - Civil Engineering

### Client/Sponsor

Kiersten Lee - MWH Constructors  
EmMinner - MWH Constructors

### Faculty Advisor

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

## USACE FISH LADDER TEMPERATURE CONTROL DESIGN

The Lower Monumental Dam near Walla Walla, WA, has a fish ladder to allow anadromous fish to return upstream to spawn. These fish are deterred from advancing upriver when they encounter warm water or temperature differences. During summertime conditions, the warm reservoir discourages the fish from exiting the fish ladder, slowing their upriver journey and jeopardizing their opportunity to spawn. We created an engineering solution to encourage fish to exit promptly into the reservoir.

### Team Members

Madelynn Gregoire - Civil Engineering  
Lauren Moore - Civil Engineering  
Jayr Ayala - Civil Engineering  
Theodore Ertel - Civil Engineering

### Client/Sponsor

Jarrod Milligan - U.S. Army Corps of Engineers  
RyanLaughery - U.S. Army Corps of Engineers

### Faculty Advisor

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

## POST FALLS APARTMENTS

We are designing the site of a new apartment complex in Post Falls, ID, near the Washington border and with close freeway access. This project will help address the housing shortage in the area.

### Team Members

Parker Schwars - Civil Engineering  
Aliyana Avalos - Civil Engineering  
Noah George - Civil Engineering

### Client/Sponsor

Joanna Litalien - TO Engineers

### Faculty Advisor

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

## Computer Science

### AUTOMATED VISIO CONSTRUCTION

Software Defined Network (SDN) switches, produced by SEL, are complex systems that control and regulate communications between other devices. These systems are visualized through Microsoft Visio diagrams. Currently, these diagrams are created and exported to a spreadsheet. Our project's goal is to reverse the process by converting the data from a provided spreadsheet into a Visio diagram and implementing a mapping algorithm to place and order Visio shapes to represent the data.

### Team Members

Sophia Sivula - Computer Science  
Ross Prestwich - Computer Science  
Creed Thie - Computer Engineering  
Morgan Brockman - Computer Engineering

### Client/Sponsor

Jason Dearien - Schweitzer Engineering Laboratories

### Faculty Advisor

Bruce Bolden - U of I Department of Computer Science

### AUTOCALIBRATION SOFTWARE FOR OPTICAL RECEIVER ARM ALIGNMENT

Our goal is to create software that enables automated calibration for Hansen Photonics' fiber optic launching system, which allows greater access to affordable internet for underserved areas. Because the system works completely over-the-air and by line-of-sight, it avoids the costly and destructive process of laying fiber optic cables. The existing method of calibration done manually was cumbersome. Our system does not require constant human attention and achieves calibration more quickly.

### Team Members

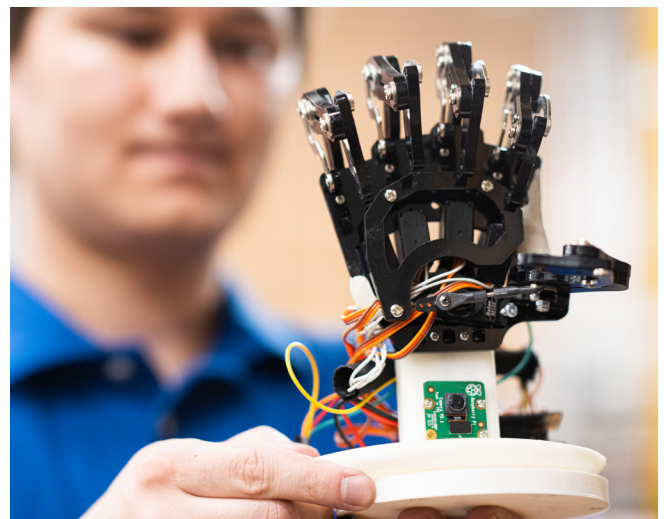
Ethan Corgatelli - Computer Science  
Donald Hammer - Computer Science  
Hunter Leppek - Computer Science  
Joseph Miller - Computer Engineering

### Client/Sponsor

JP Hansen - Hansen Photonics, Inc.

### Faculty Advisor

Bruce Bolden - U of I Department of Computer Science





## AUTOMATED INSTALLATION OF KEYS

Our project is to automate an existing process at Schweitzer Engineering Laboratories. Currently, employees must manually insert plastic keys into molded plugs to ensure they are connected correctly.

In our project, we use resin curing and a six-axis robot to perform this process. This removes strain on employee hands, automates a boring task, and removes the need for small plastic keys.

### Team Members

Austin Kugler - Computer Science  
John Myers - Mechanical Engineering  
Zachariah Preston - Computer Science  
Taylor Martin - Computer Science

### Client/Sponsor

Levi Gallegos - Schweitzer Engineering Laboratories  
TylerMarines - Schweitzer Engineering Laboratories

### Faculty Advisor

John Shovic - U of I Department of Computer Science

## GAMIFIED VIRTUAL WORLDS AND COMPUTER SIMULATION

Our project aims to create a virtual world within Unreal Engine that allows players to create “computers” within a virtual computer lab. By making a simulated lab, it allows for flexibility and creativity within research and education by not having to worry about increased equipment costs and real world physical constraints and consequences.

### Team Members

Feichi Han - Computer Science  
Trevor McGeary - Computer Science  
Kaleb Browning - Computer Science

### Client/Sponsor

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

### Faculty Advisor

Bruce Bolden - U of I Department of Computer Science

## BIG DATA ANALYSIS FOR ELLIPTICAL PATTERN IDENTIFICATION

This project could aid in increasing the reliability of climatological models. Current models don't include Atmospheric Gravity Wave's and incorporating them would lead to better models that would aid in improved course of action to protect the environment.

### Team Members

Luis Lopez - Computer Science  
Riley Doyle - Computer Science  
Rodney McCoy - Computer Science

### Client/Sponsor

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

### Faculty Advisor

Bruce Bolden - U of I Department of Computer Science

## Electrical Engineering

### SECURE HELIOS PROCESSOR DEMONSTRATION

The goal of our project is to demonstrate how Idaho Scientific's Helios processor is resilient to reverse engineering and cyber-attacks. This benefits the industry of critical infrastructure by providing companies with a security hardened computer processor. Our project demonstrates the security features of Helios through a live demo of cyber-attacks conducted on the processor, which is controlling an RC car.

### Team Members

Macallyster Edmondson - Electrical Engineering  
Chadwick Goodall - Electrical Engineering  
Jackie Lee - Electrical Engineering  
Robert Walko - Computer Science  
Kyle LeDoux - Computer Engineering

### Client/Sponsor

Rick Hoover - Idaho Scientific  
AndrewWeiler - Idaho Scientific

### Faculty Advisor

Yacine Chakhchoukh - U of I Department of Eletrical and Computer Engineering

### INFRASONIC WILDFIRE DETECTION AND REPORTING DEVICES

Wildfires have become more frequent and continue to threaten the environment and lives across the United States. Past research has found that wildfires can be identified by the sound they create. Our goal is to create a network of low-power, low-cost devices that can identify the sound unique to wildfires and then report an estimated location to First Responders. This technology could help detect and locate wildfires well before current methods, which would save both lives and ecosystems.

### Team Members

Mairen Chard - Biological Engineering  
Jack Lewis - Biological Engineering  
Christian Vega - Mechanical Engineering  
Kurian Georly Kunnathushery - CS  
Jiaqi Shi - Electrical Engineering  
Alhajri Abdalrahman - Electrical Engineering  
Meshari Alhajeri - Electrical Engineering

### Client/Sponsor

Joe Stanley - Stanley Solutions

### Faculty Advisor

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



## DETECTING AND LOCATING CANCELLING FAULTS IN SHUNT CAPACITOR BANKS

The objective of our project is to develop an algorithm that can detect symmetric & asymmetric canceling faults in Shunt Capacitor Banks (SCB) to help electrical engineering students in the Power Lab.

### Team Members

Mohammad Al Ebedan - Electrical Engineering  
Zesheng Guo - Electrical Engineering  
PeiCheng Ji - Electrical Engineering  
Zeying Chen - Electrical Engineering

### Client/Sponsor

Satish Samineni - Schweitzer Engineering Laboratories  
JadaHawaz - Schweitzer Engineering Laboratories

### Faculty Advisor

Yacine Chakhchoukh - U of I Department of Electrical and Computer Engineering

## MARS JAVELIN

We are testing a model payload on Earth for the sake of launching a model on Mars. This model will acquire valuable data for NASA that will allow further progress towards development of other projects relating to the exploration of Mars. Previous work has been done, but for various reasons some of these projects fell through. As a result, "The Spear of Ares", has the objective of designing, building, and testing a model that will survive in a simulated Martian environment.

### Team Members

Shujea Aldousari - Electrical Engineering  
Owen Blair - Electrical Engineering  
Johnathan Kopf - Computer Science  
Michael Myers - Mechanical Engineering  
Kyle Rast - Mechanical Engineering  
Steven Rougeux - Biological Engineering  
Tao Wang - Computer Science

### Client/Sponsor

Marcus Murbach - NASA Ames Research Center  
MalachiMooney-Rivkin - NASA Ames Research Center

### Faculty Advisor

Yacine Chakhchoukh - U of I Department of Electrical and Computer Engineering

## AI/ML BASED NATURAL LANGUAGE INTERFACES TO DATABASES

Individuals in numerous fields from the sciences to finance regularly work with crucial information stored in electronic databases, the information in which is not easily accessible without learning query languages like Structured Query Language (SQL). Pre-existing Natural Language to SQL solutions allow non-technical users to easily access database information. The team aims to improve upon these systems through increased accuracy and generalization to different databases.

### Team Members

Seth Cram - Electrical Engineering  
Khoi Nguyen - Electrical Engineering

### Client/Sponsor

Hasan Jamil - University of Idaho

### Faculty Advisor

Yacine Chakhchoukh - U of I Department of Electrical and Computer Engineering

## Mechanical Engineering

## LEG EXOSKELETON FOR MULTIPLE SCLEROSIS

Our client has Primary Progressive Multiple Sclerosis and would benefit from assistance on his weaker side. The goal of this capstone is to create an assistive leg exoskeleton that will aid in our client's ability to walk independently. Our solution is a Bowden cable based system that uses linear actuators as a mechanism for ankle motion assistance. An Arduino microcontroller connected to a remote will be used to control the actuators according to our client's gait cycle.

### Team Members

Ashley O'Connor - Mechanical Engineering  
Trenten Patton - Biological Engineering  
Joshua Wilson - Mechanical Engineering  
Josie Wicklund - Computer Science

### Client/Sponsor

Kevin Rhoades - Dean and Cindy Haagenson Endowment

### Faculty Advisor

Steve Beyerlein - U of I Department of Mechanical Engineering

## CRYOGENIC TENSILE TESTER

Our team is working on a user-friendly, inexpensive, and accurate way to understand how materials behave at temperatures as low as 100K (-280°F). We're interested in their tensile properties—how they respond to being stretched. We started with a machine that was not fully functional. Our project focuses on improving the data acquisition systems and the user interface.

### Team Members

Ryan Sundburg - Mechanical Engineering  
Kathryn Reece - Mechanical Engineering  
Ethan Hinkle - Computer Engineering  
Seth Lunders - Computer Engineering  
Chase Gornick - Computer Engineering

### Client/Sponsor

NASA Idaho Space Grant Consortium

### Faculty Advisor

Michael Maughan - U of I Department of Mechanical Engineering

## PRANDTL-D FLYING WING DEMONSTRATION

We designed a powered proof-of-concept flying wing based on the highly efficient Prandtl airfoil patented by NASA. This project serves as the first step in demonstrating the commercial viability of this design in real world UAV applications.

### Team Members

Taylor Herndon - Mechanical Engineering  
Nicolas Burrows - Mechanical Engineering  
Keenan Bryan - Mechanical Engineering  
Augustine Almanza - Computer Science  
Zach Heimbigner - Computer Science

### Client/Sponsor

Brian Boogaard - NASA  
Dave Berger - NASA

### Faculty Advisor

Vibhav Durgesh - U of I Department of Mechanical Engineering



## AIRCRAFT FUEL CRASH SHUTOFF SAFETY VALVE

The objective is to shut off fuel in an aircraft right when a crash happens in an attempt to minimize the severity of post-crash fires to help save lives.

### Team Members

Abdulsalam Alghamdi - Mechanical Engineering  
 Andrea Tomchak - Mechanical Engineering  
 Dawson Hicks - Mechanical Engineering  
 Tyler Bendele - Electrical Engineering  
 Dean Johnson - Electrical Engineering

### Client/Sponsor

Jamie Slippy - Kodiak Aircraft

### Faculty Advisor

Matthew Swenson - U of I Department of Mechanical Engineering

## PENDANT CONTROLLER FOR AUTOMATED FORK TRUCK

Modern self-driving forklifts are designed to operate without human interaction, however there are situations where a human operator will need to take control. The goal of this project is to develop a wired controller that allows a user to take manual control of an automated forklift for maintenance and training purposes. The results of this project will help provide further development of this technology and may be adjusted for application in other, similar automated vehicles.

### Team Members

Katelyn Kinson - Mechanical Engineering  
 Oakley Todd - Mechanical Engineering  
 Ernesto Orozco - Mechanical Engineering  
 Ben Bunce - Electrical Engineering  
 Ross Dunworth - Electrical Engineering

### Client/Sponsor

Gabe Riggs - Bastian Solutions

### Faculty Advisor

Steve Beyerlein - U of I Department of Mechanical Engineering

## DEMONSTRATION OF SMALL-SCALE CONTINUOUS CASTING

Uranium fuel pins, as used in current nuclear reactors, are manufactured using reliable, but wasteful and inefficient methods. Our focus is to demonstrate the feasibility of using continuous casting as a method of producing the fuel pin geometry using a stable, low-melting point alloy. Continuous casting has the potential to drastically reduce hazardous waste, increase production rate of the fuel pins, and allow for previously impractical geometries.

### Team Members

Kade Forbes - Materials Science  
 Timothy Stevens - Mechanical Engineering  
 Brennen Coulson - Mechanical Engineering  
 Tristan Denning - Electrical Engineering  
 Wyatt Knickerbocker - Computer Science

### Client/Sponsor

Randall Fielding - Idaho National Laboratory

### Faculty Advisor

Michael Maughan - U of I Department of Mechanical Engineering

## ROBOTIC ASSEMBLY OF PHOTOVOLTAIC ARRAYS

The current construction of solar arrays is costly, time-consuming, and error-prone due to them being assembled by hand. By developing NASA's patented 4-step process, our project aims to automate the assembly of solar panels for more efficient and precise manufacturing. Our goal is to improve the existing process through the use of two robotic arms. Our proof of concept uses surrogate materials to minimize cost while illustrating production improvements in quantity and size.

### Team Members

Tyler Groner - Mechanical Engineering  
 Holly Keir - Computer Science  
 Grant Lucke - Mechanical Engineering  
 Glen Findlay - Mechanical Engineering  
 Chandler Calkins - Computer Science  
 David Vorous - Electrical Engineering

### Client/Sponsor

Brian Boogaard - NASA Technology Transfer Administrator  
 John Carr - NASA

### Faculty Advisor

Michael Maughan - U of I Department of Mechanical Engineering

## RECIPROCATING SAW END-EFFECTOR FOR HOT-CELL ROBOTIC ARM

Idaho National Laboratory utilizes a room called a hot-cell to contain irradiated materials. Due to the nature of the radioactive materials, they must be handled remotely. The future plan is to implement robotic arms which will be inside the hot cell and will be controlled by operators who are outside of the hot-cell. Our team has designed a reciprocating saw end-effector for these robotic arms, enabling operators to cut irradiated materials.

### Team Members

Bennett Schlect - Mechanical Engineering  
 Cameron Summerfield - Mechanical Engineering  
 Kyle Monaghan - Mechanical Engineering  
 Blake Hansen - Mechanical Engineering

### Client/Sponsor

Jesse Kappmeyer - Idaho National Laboratory

### Faculty Advisor

Matthew Swenson - U of I Department of Mechanical Engineering



## UNIVERSAL CIRCUIT BOARD PALLET

SEL manufactures circuit boards for each of their products. Validation of these boards requires each one to be individually tested. SEL wishes to optimize the testing process with new automatic testing machines. Each board design requires a unique pallet to move the board through the tester. These pallets must be custom made for each new board design. The goal of this project is to create a pallet that will adapt to many different board designs reducing overall cost, time, and storage space.

### Team Members

Tyler Sand - Mechanical Engineering  
Stratton Jenks - Mechanical Engineering  
Ben Wren - Mechanical Engineering  
Michael Cadmus - Mechanical Engineering

### Client/Sponsor

Jonathan Richards - Schweitzer Engineering Laboratories  
Alex Olson - Schweitzer Engineering Laboratories  
Christian O'Bryan - Schweitzer Engineering Laboratories

### Faculty Advisor

Matthew Swenson - U of I Department of Mechanical Engineering

## MLM ARMREST ADJUSTMENT LOCKING MECHANISM

The Mini-lever Module (MLM) armrest houses all of the controls necessary to operate the Hyster-Yale forklifts. Much like a car steering wheel, each operator needs to adjust the armrest to a position that is comfortable. The current system requires two handle pulls to unlock. The goal of the project is to design a locking mechanism on their forklifts that unlocks with the pull of one handle. The value of the project is to streamline adjustments for operators and keep up with competition.

### Team Members

Michael Williams - Mechanical Engineering  
Chris Shultz - Mechanical Engineering  
Colin Nancarrow - Mechanical Engineering

### Client/Sponsor

Samuel Weiss - Hyster-Yale Material Handling  
Trevor Harris - Hyster-Yale Material Handling

### Faculty Advisor

Matthew Swenson - U of I Department of Mechanical Engineering



## OIL FILM INTERFEROMETRY

We are improving the aerodynamics of Kodiak Aircraft. Higher drag forces on the horizontal stabilizer have been noted due to patterned roughness from universal head rivets on the airfoil surface. We will quantify the impact of the rivet heads on performance and decide if the airfoils should have flush-mounted rivets for future aircraft design.

### Team Members

Shalom Masango - Mechanical Engineering  
Ryan Schaefer - Mechanical Engineering  
Brendyn Goodwin - Mechanical Engineering

### Client/Sponsor

Brandon Stille - Kodiak Aircraft  
Jamie Slippy - Kodiak Aircraft

### Faculty Advisor

Vibhav Durgesh - U of I Department of Mechanical Engineering

## IMPULSE MEASUREMENT DEVICE: MEASURING FORCES CREATED BY RIMFIRE AMMUNITION

Shooting rimfire firearms is popular due to cost, recoil, and availability. Autoloading rimfires use shot energy to cycle cartridges. Cycling failures costs the shooter time and money. Chamber pressure curves are available, but there is little other information correlated to reliable cycling. Our goal is to build a fixture to quantify the axial and radial forces during firing, to better understand how they correlate to proper cycling in firearms, allowing manufacturers to reduce failure rates.

### Team Members

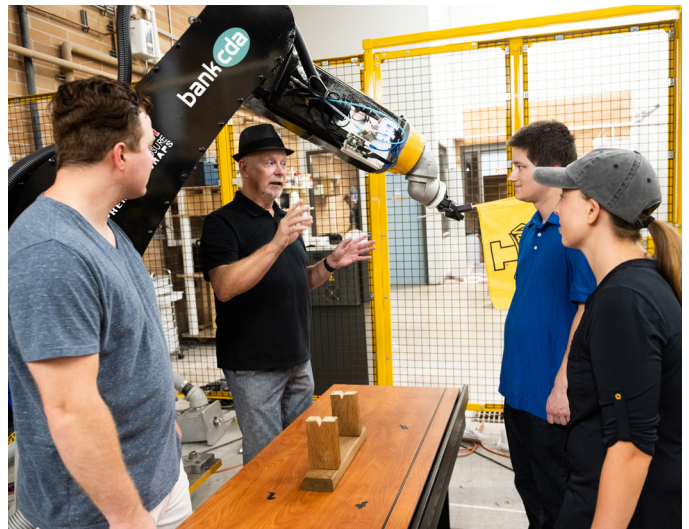
Shane Elmore - Mechanical Engineering  
Patrick Chmelik - Mechanical Engineering  
Kyle Christopher - Mechanical Engineering

### Client/Sponsor

Jeff Williams - Vista Outdoor

### Faculty Advisor

Michael Maughan - U of I Department of Mechanical Engineering





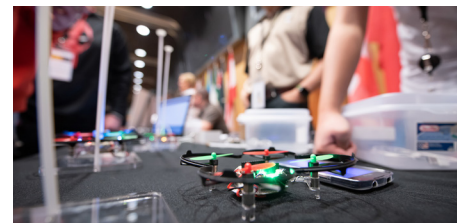
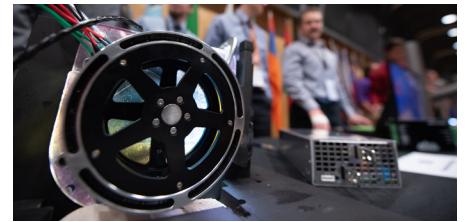
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“The Breezy Night Light”



**Allison McCormick**  
“Apple Iris”



**Mia Stroh**  
“The Viewer”

## 2023 EXPO ORGANIZING COMMITTEE

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

### Event Management

- Patricia Colberg, 2023 EXPO Organizing Chair  
Associate Dean  
[colberg@uidaho.edu](mailto:colberg@uidaho.edu)
- Elizabeth Marshall  
Assistant Director of Special Events  
& Student Engagement  
[emarshall@uidaho.edu](mailto:emarshall@uidaho.edu)
- Sue Branting, Financial Specialist-Lead  
Department of Computer Science  
[sueb@uidaho.edu](mailto:sueb@uidaho.edu)

### Sponsorship

- Bobbi Hughes, Executive Director  
of Advancement  
[bhughes@uidaho.edu](mailto:bhughes@uidaho.edu)
- Maggie Scott, Associate Director  
of Development  
[maggies@uidaho.edu](mailto:maggies@uidaho.edu)

### Senior Capstone Design Program

- Matt Swenson, Capstone Program Director  
Assistant Professor, Mechanical Engineering  
[swenson@uidaho.edu](mailto:swenson@uidaho.edu)

### EXPO Extended Experience

- Katie Schiffelbein  
Micron Director of Diversity, Inclusion, and Outreach  
[kschiffelbein@uidaho.edu](mailto:kschiffelbein@uidaho.edu)

### Marketing & Communications

- Alexis Turner, Marketing & Communications Manager  
[alexisst@uidaho.edu](mailto:alexisst@uidaho.edu)





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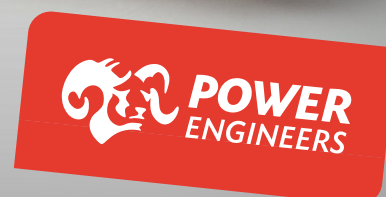
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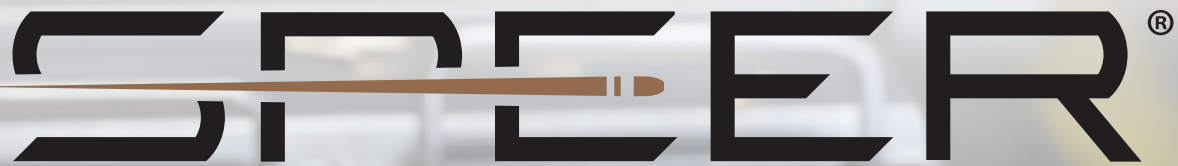




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