

2023

**IDAHO GLOBAL
ENTREPRENEURIAL MISSION
ANNUAL REPORT**



IGEM



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PHOTO COURTESY: BOISE STATE UNIVERSITY

WHAT IS IGEM?

The Idaho Global Entrepreneurial Mission (IGEM) is a unique program that invests public funds in advanced university research and capacity building to further economic development initiatives for the state.

The IGEM grant program uses a three-pronged approach to support a statewide entrepreneurial and commercialization pipeline to bring to market advances in industries vital to the state's economy. IGEM successfully advances important research projects, funding strategic research capacity investments and propelling innovations that position Idaho industries in new and profitable markets.

This annual report provides a succinct update on the IGEM program, its funded projects and successes over the past 11 years.

IGEM-COMMERCE OVERVIEW

The IGEM-Commerce grant program funds research initiatives where university investigators and private

sector business experts partner together to bring viable technologies to market. IGEM-Commerce commercialization grants are a powerful economic resource. Through its support of commercialization partnerships, IGEM-Commerce invests in developing new business ventures and creating new products and high-value jobs, while supporting the research capacity of Idaho's universities.

At the helm of the IGEM-Commerce program is the IGEM Council, a twelve-member body appointed by the Governor as prescribed in Idaho Code section 67-4726. The IGEM Council's diverse and experiential make-up consists of the brightest business, research, policy, strategy and financial minds in the state.

The council thoroughly vets IGEM-Commerce grant proposals to mitigate risk and maximize the return on investment. The IGEM Council's fiscal stewardship and strategic direction advances IGEM's overall intended goal of economic prosperity through investments in technological advancements and innovation.

IGEM PROVIDES THREE DISTINCT FUNDING OPPORTUNITIES

\$1M

IGEM-COMMERCE

Managed by Idaho Commerce under the direction of the IGEM Council.

Funds research ventures where industry and university partnerships work together to bring viable products and technologies to market.

\$2M

IGEM-HERC

Managed by the State Board of Education (SBOE) and administered by the Higher Education Research Council (HERC).

Invests funds to support infrastructure and advance key capacities at Idaho's research universities.

\$3M

IGEM-CAES

Managed by the SBOE and administered by the Center for Advanced Energy Studies (CAES).

Leverages the partnerships between Idaho's three public research universities (Boise State University, Idaho State University and University of Idaho) and Idaho National Laboratory to fund advanced energy projects and initiatives.

IGEM-COMMERCE GRANT PROGRAM

With \$1 million in annual funding, Idaho Commerce awards \$950,000 in grants, utilizing \$50,000 for administration costs. To date, IGEM-Commerce has funded 43 original projects and 8 supplemental grants, resulting in nearly \$11 million invested in university and industry research partnerships.



YEAR	APPS	FUNDED	REQUESTED	AWARDED
2023	21	5	\$5,123,650	\$784,945
2022	17	8	\$3,272,611	\$1,289,693
2021	16	7	\$3,066,777	\$1,020,240
2020	19	4	\$4,991,353	\$953,711
2019	13	5	\$3,444,862	\$1,016,728
2018	14	3	\$5,375,198	\$950,000
2017	14	4	\$3,628,640	\$979,569
2016	18	6	\$4,149,029	\$1,104,830
2015	14	3	\$3,044,732	\$950,000
2014	20	4	\$3,506,145	\$972,371
2013	18	7	\$3,088,169	\$844,093
TOTAL	184	56	\$42,691,166	\$10,866,180



YEAR	APPS	AVERAGE REQUEST	AVERAGE AWARD
2023	21	\$243,983	\$156,989
2022	17	\$192,507	\$161,211
2021	16	\$191,674	\$145,748
2020	19	\$262,703	\$238,428
2019	13	\$264,989	\$203,346
2018	14	\$383,943	\$316,667
2017	14	\$259,189	\$244,892
2016	18	\$230,502	\$184,138
2015	14	\$234,210	\$316,667
2014	20	\$175,307	\$243,093
2013	18	\$171,565	\$120,585
PROGRAM AVERAGES	17	\$233,285	\$194,039





IGEM COUNCIL

The IGEM Council is a 12-member authoritative body appointed by the Governor to preside over the IGEM program. The council thoroughly vets IGEM grant proposals to mitigate risk and maximize the return on investment. The IGEM Council's fiscal stewardship and strategic direction advance IGEM's overall intended goal of economic prosperity through investments in technological advancements and innovation.

FY2023 MEMBERS

- RICK STOTT (CHAIR)** SUPERIOR FARMS
- TOM KEALEY** - DIRECTOR, IDAHO COMMERCE
- DR. MARIANNE WALCK** - IDAHO NATIONAL LABORATORY
- SHAWN KEOUGH** - STATE BOARD OF EDUCATION
- DAMOND WATKINS** - STELVIO STRATEGIES
- JUAN CARLOS DUQUE** - RANDOM ROCK CONSULTING GROUP
- DR. MARTIN BLAIR** - IDAHO STATE UNIVERSITY
- DR. NANCY GLENN** - BOISE STATE UNIVERSITY
- DR. CHRISTOPHER NOMURA** - UNIVERSITY OF IDAHO
- SENATOR KELLY ANTHON**
- REPRESENTATIVE JEFF EHLERS**
- VACANT** - IDAHO BUSINESS AT LARGE



COMMERCE DIRECTOR, TOM KEALEY, SPEAKS AT HEMPITECTURE'S GRAND OPENING.

products. These will be used across multiple industries and play an integral role in the supply chain of hemp and bio-insulation products.

Hempitecture's new facility successfully started the manufacturing line which marks the first-time bio-insulation products have been used in the U.S.

For the past three years, Hempitecture has continued to partner with the University of Idaho (UI) through the IGEM grant program to conduct testing on their HempWool products.



MATTIE MEAD PROVIDES A TOUR OF HEMPITECTURE'S NEW FACILITY.

IGEM SUCCESS STORIES

HEMPITECTURE UNVEILS NEW FACILITY

Three-time Idaho Global Entrepreneurial Mission (IGEM) program grant industry partner, Hempitecture, recently celebrated an important milestone — the grand opening of its new state-of-the-art, first-of-its-kind manufacturing facility.

In February 2023, Hempitecture held a ribbon-cutting ceremony to unveil their new 33,000 square-foot facility located in Jerome — kicking off the production of their flagship product, HempWool.

Hempitecture manufactures plant-based building materials, utilizing the husk of hemp stalks, to create building products such as HempWool.

The new facility will run on renewable energy and produce a wide range of bio-based non-woven

Since receiving the initial grant award of \$206,624 to test fire retardancy and thermal insulation of the product, UI has received two additional supplemental awards of \$106,175 and \$100,141 to continue research.

“We are really thankful for Idaho Commerce and its support,” Hempitecture founder Mattie Mead said. “We get to continue our research into the future, which is exciting because that affords us the opportunity to take this research and bring it to the industrial real-world full-scale level. It has been a great year of working with the team and I feel like we are actually picking up momentum and inertia moving forward.”



THE ULTIMATE GOAL OF THE GEOSYSTEMS PROJECT IS TO REUSE NATIVE SOIL IN ROAD CONSTRUCTION.

PRESTO GEOSYSTEMS BEGINS PROJECT WITH ITD

Although many IGEM projects go through countless tests over the course of the project periods to simulate real-world environments, it is very rare that a project is actually used in a real-world environment during the research period.

Boise State University (BSU) and partner Presto Geosystems are doing just that.

This fiscal year, a supplemental award of \$30,000 was awarded to BSU to take advantage of a unique opportunity provided by the Idaho Department of Transportation (ITD) to test the performance of Geocell's soil stabilization technology in a real-world application.

Presto Geosystems manufactures geosynthetic products such as Geocells, a soil stabilization system that is the product at the forefront of this research project.

BSU partnered with Presto Geosystems to develop new methods of building pavement bases using native soil and Geocells. The project ultimately plans to reintegrate excavated material back into pavement construction. Reusing the native soil, not only saves money but

also lessen environmental impacts from emissions and soil disposal.

BSU researchers and Presto Geosystems plan to put the Geocells in a 100-foot stretch of highway in Marsing on U.S. Highway 95.

Not only will the application of Presto Geosystems' product provide much needed additional testing and information for the researchers, but also will help to address swelling soil issues in the section of the highway.

“This supplemental award has helped us quite a bit,” Chair and Professor at Boise State University, Dr. Bhaskar Chittoori said. “We are learning a lot as part of this. I am very, very thankful, and very grateful for the support.”

This supplemental funding is in addition to funds awarded through the IGEM program in FY2022 in the amount of \$286,316.



PHOTO COURTESY: BOISE STATE UNIVERSITY

YEARS LATER, INERGY CONTINUES TO MAKE STRIDES

Even though Inergy's research grant with the University of Idaho (UI) has closed out, the company has continued to reach new and exciting milestones.

Inergy, which is based in Pocatello, is a technology company focused on developing innovative products to harness and store renewable energy for everyday use.

The company started in 2012, and in partnership with UI, received an IGEM award in FY2016 for \$178,178.

The IGEM grant program provided much-needed research and funding the company needed to develop a Gallium Nitride inverter to deliver whole-home scale power that is still compact, lightweight and portable.

That critical research is what assisted the company in April 2023, when it announced the release of its Flex P3 Solar Generator, the first personal power plant system.



PHOTO COURTESY: INERGY

The Flex P3 uses the GaN inverter which was partially funded by IGEM.

The Flex P3 Solar Generator is lightweight and provides renewable, affordable, solar power — making it one of the most versatile power generators on the planet.

Because the Flex P3 generator is solar powered, it does not rely on traditional power generation techniques like electricity or gasoline to run, meaning it can be used anywhere at any time and recharged whenever needed.

In 2021 and 2022, Inergy also won development contracts with the U.S. Army and Air Force to introduce its innovative energy systems into the Department of Defense, another major milestone for the company.

“I am very, very excited for the future of Inergy,” Inergy CEO Sean Luangrath said. “We are finally launching a commercial product after several years of R&D and prototyping which is incredible. The IGEM grant we received was invaluable and allowed Inergy to distinguish itself from competitors.”

PHOTO COURTESY: INERGY



INERGY'S FLEX P3 SOLAR GENERATOR.



PHOTO COURTESY: INERGY

IGEM-COMMERCE COMPLETED PROJECTS (FY2013 - FY2023)



LEARN MORE ABOUT IGEN-COMMERCE
COMPLETED PROJECTS ON OUR WEBSITE

IGEM.IDAHO.GOV/COMPLETED-PROJECTS

YEAR	SCHOOL	PROJECT	AWARD
2021	BSU	Novel Metallic and Nanomaterial Coatings and Application Process for Optical Fibers and Sensors	\$130,970
2021	BSU	Multi-printer Compatible Nanoparticle Inks for Advanced Manufacturing Methodologies	\$196,324
2020	BSU	Novel Movement and Inspection System for Drones to Improve Infrastructure	\$395,317**
2020	UI	Free to Feed Food Allergen Test Kit for Human Milk	\$255,496
2020	BSU	Development of a Scalable Manufacturing Process for OnChip Color Tunable Lasers	\$242,114
2019	BSU	Development in Optimizing Laser Metal Deposition Additive Manufacturing Techniques	\$274,167
2019	UI	Converting Agricultural Waste Into An Effective Nematode Suppressing Food and Fertilizer	\$241,667
2019	ISU	Washie Sanitizing Toilet Seat	\$82,792
2019	ISU	ARPRI: Augmented Reality Platform for Robotic Systems Design and Interaction	\$162,606
2018	BSU	A General-Purpose Goniometer	\$368,772
2018	UI	Modeling and Design of Borated Aluminum Cask for Used Fuel Cooling	\$237,898
2018	BSU	MSM Micro-Pump	\$343,330
2017	ISU	HOPlite Skate Armor Testing	\$111,453
2017	BSU	Flexible Sensors Assisted Miniaturized Air Scrubber for Protecting Stored Potatoes	\$413,681
2017	BSU	Time-Of-Flight Spectroscopic Reflectometer	\$260,435
2017	BSU	Remote Sensing of Alfalfa Seed Crop Bloom	\$194,000
2016	UI	6,000 Watt Split Phased Gallium Nitride High Frequency Inverter	\$178,178
2016	UI	Technology Development for Efficient Provision of UAS Products	\$161,524
2016	BSU	Evaluation of the Ankle Roll Guard's Effectiveness to Improve Clinical Benefit	\$148,927
2016	BSU	Sensor Adapter for Enhanced M2M Integration	\$211,098
2016	UI	Smart Raised Pavement Marking Integration with Traffic Signal Control Systems	\$299,651
2016	UI	Licensing and Commercialization of a Live Attenuated Aquaculture Vaccine	\$105,452
2015	BSU	Precision Ag-Increasing Crop Yields Using Internet of Things & Data Science	\$343,072
2015	ISU	Expanding Precision Agriculture Market Opportunities with UAS Sensors	\$179,755
2015	UI	N-E-W Tech: Innovation at the Nutrient, Energy, Water Nexus	\$427,173

IGEM-COMMERCE COMPLETED PROJECTS (CONTINUED)

YEAR	SCHOOL	PROJECT	AWARD
2014	BSU	Innovative Surfactant Strategies: Sustainable Recycling and New Manufacturing	\$265,000
2014	ISU	RISE Analytical Services	\$300,000
2014	UI	2E-Hexenal: The Future of Potato Disease Control in Storage	\$296,917
2014	BSU	Preclinical Testing of Hip Resurfacing Technology	\$110,454
2013	BSU	Preparation and Preclinical Testing of DNA-Modifying Anticancer Agents	\$80,986
2013	ISU	Nanofabrication Infrastructure Support	\$250,000
2013	UI	High Speed Digital Package Measurement and Modeling for Next Generation Memory Modules	\$150,000
2013	UI	An Innovative Pesticide Application Technology System for Increasing the Effectiveness and Reducing Pesticide Off-Target Movement	\$46,146
2013	UI	A University-Industry Partnership to Determine the Commercial Viability of Automated Qualitative Detection of E.coli O157:H7 Applicable at a Beef Processing Facility	\$78,076
2013	UI	Commercializing Newly Developed Aquatic Animal Health Products to Benefit Aquaculture Through Disease Reduction	\$124,021
2013	UI	Application of Microbial Induced Calcite Precipitation to Improve the Strength and Engineering Characteristics of Soils on a Field Scale	\$114,864

****GRANT RECEIVED TWO SUPPLEMENTAL AWARDS.**

IGEM-COMMERCE FY2023 GRANT AWARDS

In Fiscal Year 2023, IGEN awarded two grants to new commercialization projects, and three supplemental grant awards to existing IGEN projects. This is a total of \$784,945 toward research and development of innovations that benefit Idaho companies and the economy.

Now in its eleventh year, IGEN has funded 56 projects, investing nearly \$11 million dollars in university and industry research partnerships.

UNIVERSITY PARTNER	AWARD	PROJECT
University of Idaho	\$348,632	Prototyping Solar-Powered Autonomous Vehicles to Build Plant Phenotype Database in Idaho
Boise State University	\$210,772	Functional Food Ingredient - Potato Protein Concentrate
University of Idaho	\$100,141	Testing New Manufacturing Methods of Natural Fiber Insulation Batts*
Boise State University	\$95,400	PEF Potato Processing Advantage*
Boise State University	\$30,000	Novel Pavement Bases Using Geocells with MICP Treated Infills*
TOTAL	\$784,945	



*SUPPLEMENTAL AWARD

FUNCTIONAL FOOD INGREDIENT POTATO PROTEIN CONCENTRATE

Boise State University

FY2023 Award Amount: \$210,772

Together, Boise State University (BSU) and industry partner, Valley Food Tec, LLC are working together on research and development for the use of new extrusion processes and applications for potato protein.

The protein will be isolated using an acid-heat coagulation method. The isolated protein will be texturized by the twin screw hot melt extruder to improve the physicochemical and functional properties of the potato protein concentrate.

The potato protein concentrate and texturized protein will be used in making functional plant-based products, including ready-to-drink powder mixes, meat analogues and potato protein based “chicken” nuggets. After isolating the potato protein, the aqueous starch by-product will be used as an ingredient for other food applications, like batters for fried foods.



AIGEN'S UNMANNED GROUND VEHICLE WILL ASSIST WITH WEED AND NUTRIENT MANAGEMENT CHALLENGES.

Weed and nutrient management is one of Idaho growers' most significant input costs.

AIGEN's hardware and software platform referenced as unmanned ground vehicles will be utilized to address management challenges driven by water stress, nutrient deficiencies, insect outbreaks and disease and weed infestations.

The vested interest for this project is leveraged by various stakeholders, including sugar beet and onion growers across Idaho. Based on the UI team's past experiences on plants, soil and drought issues and cohesive collaborations with local growers, tangible outcomes and deliverables are highly expected.

PHOTO COURTESY: BOISE STATE UNIVERSITY



THE BSU PEF POTATO PROTEIN RESEARCH GROUP.

PROTOTYPING SOLAR-POWERED AUTONOMOUS VEHICLES TO BUILD PLANT PHENOTYPE DATABASE IN IDAHO

University of Idaho

FY2023 Award Amount: \$348,632

The University of Idaho (UI) and industry partner, AIGEN Inc. are collaborating to collect and analyze a high-fidelity database of plant phenotypes and other relevant crop data in Idaho to promote agricultural research.



PHOTO COURTESY: UNIVERSITY OF IDAHO



CONDUCTING TESTS ON HEMPITECTURE'S HEMPWOOL FIBER BATTS ARE THE FOCUS OF THIS IGEN PROJECT.

partnership between UI and Hempitecture has been productive over the years with both students and the company benefiting from this collaboration.

NOVEL PAVEMENT BASES USING GEOCELLS WITH MICP TREATED INFILLS

Boise State University
FY2023 Supplemental Award Amount: \$30,000
FY2022 Award Amount: \$286,316

Boise State University (BSU) has partnered with Presto Geosystems to develop a sustainable alternative to pavement and foundation bases so that the reliance on quarry aggregates can be minimized.

This project combines Microbially Induced Calcite Precipitation (MICP), a soil strengthening technique, with Geocells so that native soils can be used as infill in place of excavated quarry aggregates.



A \$30,000 supplemental award was provided to the project team in May 2023 to take advantage of the opportunity provided by the Idaho Department of Transportation (ITD) to test the performance of the MICP/Geocell soil stabilization technology in a real-world application, a 100-foot live stretch of highway.

ITD's willingness to engage in innovative practices to address the swelling soil issues is a testament to the successful research history and existing implementations developed by the research group. The collaboration with ITD and the comprehensive support from IGEN-Commerce and BSU's College of Engineering underlines the strategic alignment and potential impact of this research initiative.

TESTING NEW MANUFACTURING METHODS OF NATURAL FIBER INSULATION BATTS

University of Idaho
FY2023 Supplemental Award Amount: \$100,141
FY2022 Supplemental Award Amount: \$106,175
FY2021 Award Amount: \$206,624

The University of Idaho Integrated Design Lab and Idaho-based start-up company, Hempitecture, are collaborating to develop new bio-based building products. These insulation products are derived from agricultural hemp fibers, which can be grown in Idaho.

The Integrated Design Lab (a research branch of the College of Art and Architecture) is conducting pilot tests on thermal conductivity while researchers in the College of Natural Resources are testing product additives that will protect against fire and biodegradation.

With the supplemental funding received in May 2023, the research team will help Hempitecture expand its product lines.

Manufacturing of the insulation batts is underway in Idaho. The process results in short cellulose fibers as a by-product. These short fibers could be used for loose-fill insulation or made into fuel pellets for stoves, which would add new revenue sources for the company.

The research team will test the heating potential of the fuel pellets and will also explore material blends and additives to enhance the loose-fill insulation. The



RESEARCHERS UTILIZE PULSED ELECTRIC FIELD TO TEST THE BENEFITS FOR POTATO CHIP PRODUCTION.

PEF POTATO PROCESSING ADVANTAGE

Boise State University

FY2023 Supplemental Award Amount: \$95,400

FY2021 Award Amount: \$291,770

Since receiving a grant in FY2021, Boise State University and Boise-based Food Physics Group have been working to showcase the benefits of pulsed electric field (PEF) technology on potato chip production. Likewise, these two partners have been monitoring the influence of PEF treatment by chemical analysis of reducing sugars, amino acids and acrylamide.

PEF treatment of Lamoka variety potatoes, followed by frying, resulted in a reduction of sugars by 25%, asparagine by 44% and the probable carcinogen, acrylamide by up to 29%.

These promising results have inspired additional measurements of oil uptake in the chips, which can be reduced by $\geq 5\%$ for a healthier, less greasy product and lighter chips that are equally as crispy as non-PEF treated control.

The extension of the potato chip project will explore the benefits of PEF treatment to reduction of acrylamide and its Maillard reaction precursor reducing sugars and asparagine in kettle-style potato and vegetable chips.

IGEM-COMMERCE IN PROGRESS PROJECTS

DEVELOPMENT OF A RIBONUCLEIC ACID (RNA) HOME TEST FOR EARLY HUMAN IMMUNODEFICIENCY VIRUS (HIV) DETECTION

Boise State University

FY2019 Award Amount: \$255,496

In FY2019, Boise State University was awarded an IGEM-Commerce grant to develop an at-home test for early human immunodeficiency virus (HIV) detection based on ribonucleic acid (RNA) from dried blood spots on paper. This project was based on a collaboration with industry partner, Molecular Testing Labs. The test will monitor RNA from the virus, which is elevated in the first few weeks of HIV infection.

The team has isolated human RNA from mailed-in dried blood spots and determined the best blotting-paper composition for analyzing RNA from dried blood spots.



THROUGH RESEARCH WITH BSU, THE PROJECT TEAM HOPES TO GATHER ADDITIONAL INFORMATION ON HIV.

Validation testing on positive controls is underway as well as quantification experiments of the HIV virus counts from each of the samples, a new U.S. Food and Drug Administration requirement in this type of testing. This validation would allow the dried blood spot test to be used for enrollment in and maintenance of HIV Pre-Exposure Prophylaxis (PrEP) drug programs.

FLOCK 54SM, A NEW GENOMIC SELECTION TOOL THAT ENHANCES THE U.S. SHEEP INDUSTRY

University of Idaho

FY2020 Award Amount: \$251,514

FY2021 Supplemental Funding Award: \$96,530

FY2022 Supplemental Funding Award: \$150,204

Flock54SM is a 1K genetic panel, developed by the University of Idaho, Rile Ag and Superior Farms, which uses DNA sequencing technology to provide low-cost genetic information to sheep producers.

Flock54SM is the first genetic testing tool of its kind to be available for the U.S. sheep industry and it is currently being used by breed registries, seed stock and commercial sheep producers.

This product provides genetic information on susceptibility of diseases, production traits and parentage which allows producers to maximize production efficiencies and the profitability of a healthier flock in one generation.

Through IGEM funding, Flock54SM has been able to make advancements on several strategic milestones: increasing producer utilization, panel utility, improving the reporting and understanding of genetic information and investigating novel genetic diseases in order to facilitate future ovine genomic research.

Flock54SM is currently finalizing the fourth version of the panel with the most economically relevant traits available for the sheep industry. The fourth panel will include carcass merit traits that will provide opportunity for stronger culling decisions tied to data. This also provides a higher level of performance data from conception to rail than any other genomic



PHOTO COURTESY: RILE AG

testing available in the sheep industry. The project team is testing on average 1,200 samples per month, almost doubling its average in 2022. During the first six months of 2023, the total number of samples tested surpassed the total number of samples for 2022.

Thanks to IGEM funding and Flock54SM ovine panel successes, the project team has also designed Goat60SM. The team is excited to make this panel available to goat producers and the industry.

The support of IGEM has enabled the expanded utility of Flock54SM and increased engagement with producers, extension specialists and industry stakeholders through several research projects to help provide valuable industry relevant solutions in the sheep and goat industry.



PHOTO COURTESY: IDAHO STRATEGIC RESOURCES

IDAHO STRATEGIC RESOURCES EMPLOYEES.

NOVEL MINING AND EXTRACTION METHODS FOR RARE EARTH ELEMENTS

University of Idaho

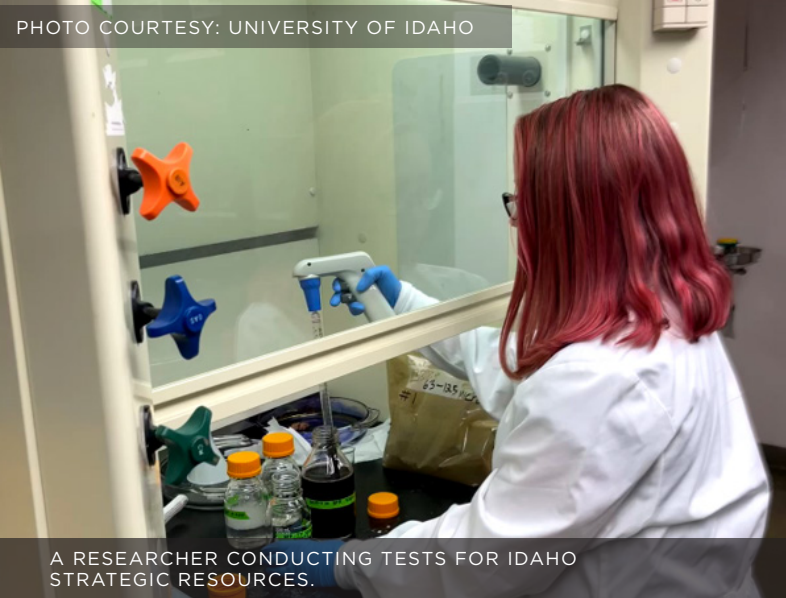
FY2022 Award Amount: \$348,241

FY2022 Supplemental Funding Award: \$92,177

This project with the University of Idaho and industry partner, Idaho Strategic Resources, Inc. focused on applying sustainable mining methods — phytomining and bioleaching — to extract rare earth elements (REEs) from Idaho-sourced soil and rocks.

Phytomining uses plants to remove metals from the soil through their roots. Bioleaching is a method that replaces the use of harmful chemicals for REEs extraction with organic weak or mild acids (e.g., gluconic and citric) capable of doing the same job.

While further testing is still needed, the team's latest



A RESEARCHER CONDUCTING TESTS FOR IDAHO STRATEGIC RESOURCES.

greenhouse experiments and results show that mustard and nightshade can be promising hyperaccumulators for phytomining, using Idaho-sourced surface soil from the Diamond Creek site near Salmon, Idaho.

A series of bioleaching experiments were conducted to investigate the effectiveness of gluconic acid for REEs extraction from Idaho-sourced soil. The results indicate that 1% solids loading produced the highest yield of REEs across all treatments.

The next steps include a phytomining survey to check 45 different plant species with different soil treatments, such as using fertilizers, biochar and weak organic acids, ultrasound-assisted bioleaching to improve the bioleaching process yield, separation and rare earth metal production, using molten salt electrolysis and techno-economic analysis (TEA) and a life cycle assessment (LCA) to determine the major cost and emission drivers.



PHOTO COURTESY: UNIVERSITY OF IDAHO

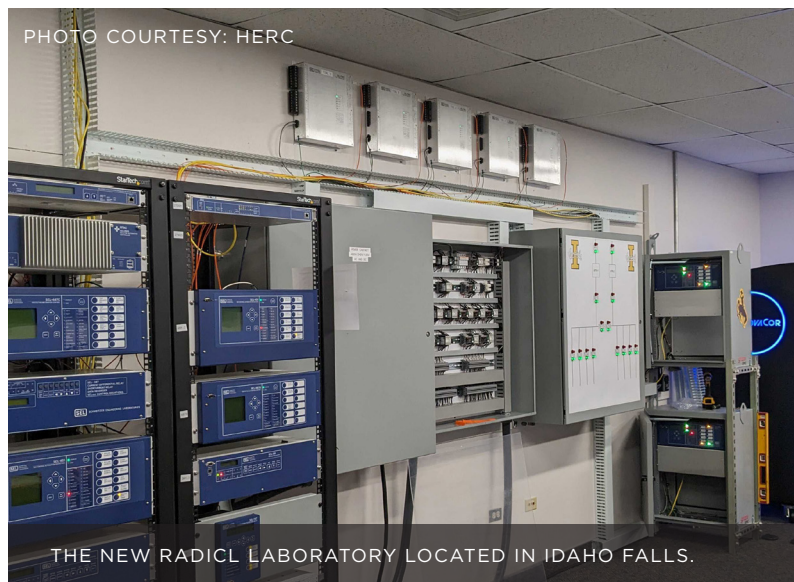
THE UNIVERSITY OF IDAHO RESEARCH TEAM FOR IDAHO STRATEGIC RESOURCES.

IGEM-HERC

IGEM-HERC (Higher Education Research Council) funds are used to support Idaho public institutions of higher education in research and development of projects that foster expertise, products and services resulting in state economic growth. Priority is granted to proposals that can show a strong collaborative effort among institutions and the private sector or exhibit high potential for near term technology transfer to the private sector. IGEM-HERC funded projects may receive funding for up to three years, contingent on annual review and satisfactory progress toward approved performance measures.

IGEM-HERC awards are granted through a competitive process that is open to each of Idaho's three public research institutions. The process incorporates an independent review of proposals and an evaluation component for identifying the project success and economic benefit to the state.

PHOTO COURTESY: HERC



THE NEW RADICL LABORATORY LOCATED IN IDAHO FALLS.

IGEM-HERC IN PROGRESS PROJECTS

LIBRARY OF RECONFIGURABLE IMMERSIVE ATTACK AND DEFEND SCENARIOS FOR CYBERSECURITY RESEARCH AND WORKFORCE DEVELOPMENT

University of Idaho
Award Amount: \$693,000

Cybersecurity is a significant component of Idaho universities' five-year Strategic Research Plan for Higher Education. Idaho's economy depends on

secure cyberspace and resilient industrial systems, and thus demands a larger highly skilled cybersecurity workforce. The University of Idaho will be working on a game-changing capability for multi-disciplined research and workforce training.

In the past fiscal year, this project has successfully built a new Reconfigurable Attack-Defend Instructional Computing Laboratory (RADICL) in Idaho Falls.

This novel, immersive, environment is integrating physical processes, full-scale enterprise IT systems and Internet-scale cyber-attacks on demand to offer researchers, students and trainees a controlled live-fire environment like no other currently available. The laboratory will be a hybrid virtual and physical environment allowing access from across the state through the Idaho Cyber Range.

Moreover, relationships with industry partners were expanded, including Schweitzer Engineering Laboratories, Westinghouse (now WESCO), Datacast Technologies and Edge Velocity to begin integrating their technologies into the laboratory. Multiple journal publications and conference papers were published in addition to a number of additional funding proposals based on the preliminary research performed in the laboratory.

The project also introduced a framework for effectively and quickly detecting malicious USB peripherals in the Cyber-Human-Physical Systems lab. This research aims to provide authentication for USB devices, to detect and prevent USB-laden attacks. In addition, the project began using the new RADICL spaces and equipment to train college students, active professionals and high school students and teachers in an immersive research environment, as well as hosted a number of cyber-related community events.

BOISE STATE UNIVERSITY FOOD AND DAIRY INNOVATION CENTER

Boise State University
Award Amount: \$684,000

The vision of this project was to create a Food and Dairy Innovation Center (FDIC) at Boise State University. The FDIC will utilize science and technology to move beyond the current standards in the food and dairy sectors. This shift is required in order to spur change in Idaho's food and dairy processing industries.

Over the past fiscal year, the team leading this project



BSU FOOD AND DAIRY INNOVATION CENTER STAFF AND PARTNERS.

completed the design and planning of FDIC labs, obtained bids and contracted with state approved contractors for laboratory construction of FDIC lab modules one and two to be completed in 2024. In year two of this project, there was a goal to submit 10 grants and generate \$1 million in external funding. The team was pleased to report that by the end of FY2023, they were able to submit 22 proposals with 14 of them getting funded and three of them currently pending.

The FDIC team mentored 12 graduate students, 45 undergraduate students and six full-time staff. Of the estimated 3-5 publications and patents for FY2023, the team published four papers with more submissions in progress. Their goal of 5-10 internships and jobs for FY2023 led to five internships and three pending jobs. The plans for FY2024 are to continue grant submissions, student mentorship, publication submissions and promote internship and job opportunities for students.

The FDIC has been exceedingly engaged with private sector companies as partners on external grants and as sponsors of funded projects.

There were 19 companies and organizations that contributed time, resources and funds in FY2023.

These partnerships and collaborative grants have led to the hiring and continued employment of three post-doctoral researchers and two research technicians for the FDIC. Industry partners have also provided internship opportunities for students in FY2023. Of the 22 grant proposals submitted in the past year, eleven of them included industry collaborators and described industry priority projects. Of the 12 grants with industry partners, eight were funded and one is pending.



THE CYBERDOME: AN INVESTMENT IN IDAHO'S FUTURE

Boise State University
Award Amount: \$700,000

The Idaho Global Entrepreneurial Mission (IGEM) program and State Board of Education Higher Education Research Council (HERC) provided the first year of funding to the Institute for Pervasive Cybersecurity (IPC) at Boise State University to build and establish the Cyberdome — a Security-as-a-Service (SECaaS) oriented platform meant to leverage force-multiplying efforts of students to secure critical cyber and physical assets of rural and remote clients.

In the past 12 months, the Cyberdome team continued to improve training for engineers and analysts based on new methods, approaches and available content. This included training on how to restore systems when they go down, how to build new system components from scratch, how to monitor the full security grid and how to scan assets for vulnerabilities. Analyst-specific training now includes exercises in simulated security events, how to detect and then threat hunt events and how to manage cases.

The Cyberdome has been able to capture the attention of new clientele. Increasingly complex clients provide real world experience for the engineers and analysts as they architect and implement sensors and monitor the events and alerts, respectively. There are currently nine active clients and nine prospective clients in varying stages of movement towards activation, far exceeding the original grant goal of five clients.

IGEM-CAES

The Center for Advanced Energy Studies is a research and education consortium between Boise State University, Idaho State University, the University of Idaho and Idaho National Laboratory.

CAES RESEARCH EXPERIENCE FOR UNDERGRADUATE PROGRAM

Ten students took part in the Research Experience for Undergraduate (REU): Advanced Manufacturing for a Sustainable Energy Future at CAES through the end of July.

The cohort worked alongside faculty from the CAES universities and INL researchers, assisting on projects related to advanced manufacturing and leveraging new capabilities at CAES, including a state-of-the-art transmission electron microscope and a suite of instruments for advanced manufacturing of sensors and instrumentation in extreme environments.

Funded by a grant from the National Science Foundation, the program runs 10 weeks each summer through 2024 and is designed to develop STEM identity and literacy while providing students with professional development guidance in the energy sector.



COMPUTATIONAL ENGINEERING AND DATA SCIENCE PROGRAM (CEADS)

CAES hosted 23 team members participating in the Computational Engineering and Data Science Program. The students collaborated with INL researchers in three focus areas: Cyber Nuclear Machine Learning, Cyber Data Science with Software Bills of Materials and Quantum Chemistry Machine Learning.

I-CREWS

The CAES universities collaborated with the Coeur d'Alene Tribe and the Shoshone-Bannock Tribes on a project that received a \$20 million five-year award from the National Science Foundation's Established Program to Stimulate Competitive Research (EPSCoR).

The project is aimed at identifying energy and water use strategies based on ongoing feedback from communities. It involves more than 35 university and college faculty, plus eight new early-career hires, 10 postdoctoral researchers, 20 graduate students and more than 120 undergraduate researchers, with supporting projects reaching more than 500 students and community members.



REU STUDENTS DISCUSSING THEIR PROJECT AT A CAES POSTER SESSION.

ATOMIC CONSORTIUM

Two BSU-led projects received funding through the Center for Atomically Thin Multifunctional Coatings (ATOMIC) consortium, of which CAES and INL are members. This is an important development as it helps jump-start a new advanced manufacturing focus area in CAES.

CAES OFFICIALLY INVOLVED WITH STATEWIDE TALENT PIPELINE MANAGEMENT INITIATIVE

CAES officially became a regional host organization for the Talent Pipeline Management (TPM) initiative in February. Launched in Idaho in 2022, the program addresses skills gaps in industries throughout the state.

It offers an employer-led approach that generates value and a return on investment for not only employers but also potential employees, schools, colleges and universities, as well as communities.

The Idaho Workforce Development Council (IWDC) was awarded \$50 million of the Idaho Governor's Office American Rescue Plan Act (ARPA) funds to launch the TPM initiative statewide. Federal funding prevents the IWDC from directly hiring project managers to execute the TPM initiative; as a result, the state identified regional representatives in six regions to implement it.

CAES was chosen as the regional host organization for Regions 5 and 6 (eastern and southern Idaho). As a host organization, CAES will hire project managers charged with facilitating efforts to lead the initiative and to ensure the program aligns with the training needs of industry and employers. CAES will receive \$300,000 annually to fund these project managers for the next two years.



REU STUDENT WORKING ON A SAMPLE IN THE CAES' ADVANCED MANUFACTURING LAB.

The TPM initiative dates to 2014, when the U.S. Chamber of Commerce Foundation launched it to address workforce development needs in emergent industries across the country. The program applies strategies to analyze projected need, growth and partnerships in education and the workforce, and to develop talent pipelines to address the current and future needs of employers.

The approach empowers employers to strategize in industry-led collaboratives, provide strategies for common workforce needs, organize and share data and proactively engage talent-sourcing providers — including education and training institutions — to build pipelines with shared value and measurable returns for all stakeholders. Nearly three dozen states have implemented the TPM initiative and Idaho is among the first to put it in place.



CAES BY THE NUMBERS*



**Since the start of the program 16 students have been offered fellowships.*

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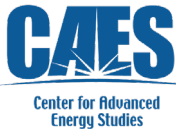
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