



2021

# IDAHO GLOBAL ENTREPRENEURIAL MISSION ANNUAL REPORT



IGEM



# TABLE OF CONTENTS

- 1** WHAT IS IGEM?
- 1** IGEM-COMMERCE OVERVIEW
- 2** IGEM-COMMERCE GRANT PROGRAM
- 3** IGEM SUCCESS STORIES
- 5** IGEM-COMMERCE COMPLETED PROJECTS
- 6** IGEM-COMMERCE FY2021 GRANT AWARDS
- 9** IGEM-COMMERCE IN PROGRESS PROJECTS
- 11** IGEM-HERC FY2021 GRANT AWARDS
- 12** IGEM-HERC IN PROGRESS PROJECTS
- 13** IGEM-HERC COMPLETED PROJECTS
- 13** IGEM-CAES
- 17** PARTNERS

## 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 nine 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 commercialization grants are a powerful economic resource. Through its support of commercialization partnerships, IGEM makes an investment in developing new business ventures, 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 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.

**\$2M**

### 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

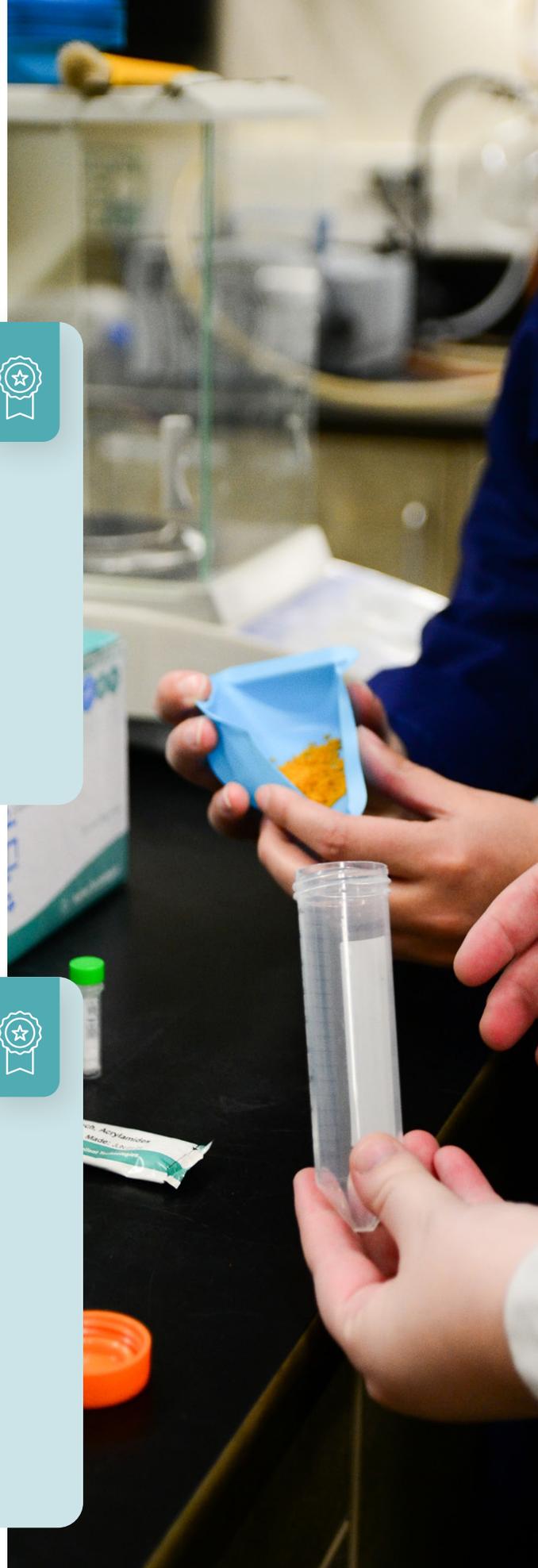
With \$1 million in annual funding, Idaho Commerce awards \$950,000 in grants, utilizing \$50,000 for administration costs. To date, IGEM-Commerce has funded 43 awards, resulting in over \$8.7 million invested in university and industry research partnerships.

YEAR	APPS	FUNDED	REQUESTED	AWARDED
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
<b>TOTAL</b>	<b>146</b>	<b>43</b>	<b>\$34,294,905</b>	<b>\$8,791,542</b>



To date, the program's largest grant award was \$427,173 with the smallest being \$46,146. Over the past nine years, the average grant request has reached nearly \$250,000 with an average award of over \$200,000.

YEAR	APPS	AVERAGE REQUEST	AVERAGE AWARD
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
<b>PROGRAM AVERAGES</b>	<b>16</b>	<b>\$236,517</b>	<b>\$204,454</b>



## IGEM SUCCESS STORIES

### HEMPITECTURE

Hempitecture is a plant-based building materials company headquartered in Ketchum, and recently announced an expansion in the Magic Valley.

Hempitecture utilizes the husk of hemp stalks to produce building products such as Hempcrete and HempWool. Hempcrete is an insulating building material that is derived from limestone and the woody core fiber of industrial hemp stalks, and HempWool is a fiber batt insulation product created using industrial hemp stalks.

Hempitecture partnered with the University of Idaho, which was awarded an IGEM-Commerce grant for \$206,624 to conduct research on the development of their natural fiber insulation, HempWool. The team will conduct tests on its ability to insulate, its fire resistancy and its thermal conductivity.

The future looks bright for the company with a new 20,000 square-foot manufacturing facility set to be developed in Jerome County, with goals to domesticate their supply chain and new hires to be onboarded in the coming months.

**“We are really thrilled to have our business located in Idaho and we are feeling very appreciative of the resources that we are afforded here in Idaho, especially now as we are working through the IGEM program with the University of Idaho,” Mattie Mead, Hempitecture CEO and Founder said. “There is a huge amount of opportunity afforded here in the state and it’s really a pleasure to be located here to grow our business.”**



STUDENTS CONDUCT TESTS ON THE THERMAL CONDUCTIVITY OF HEMPWOOL.



THE DRONE, PICTURED, WILL CONDUCT INSPECTIONS ON INDUSTRIAL INFRASTRUCTURE.

## PITCH AERONAUTICS

When there are tasks too dangerous to be performed by hand, how do you ensure the safety of industrial inspectors? This very question is what led to the foundation of Pitch Aeronautics.

Pitch Aeronautics, an Idaho-based company founded in 2016 by Ian Gibson and Dr. Zach Adams, builds ultra-precise drones capable of performing up-close and touch-based tasks and inspections on industrial and commercial infrastructure. The company partnered with Boise State University which received an IGEM-Commerce Grant for \$248,034 for drone development.

The grant enabled the team to design, conduct and test its drone prototype. This project also recently received supplemental funding from IGEM-Commerce for \$49,011 to work on their software and hardware design in response to customer feedback.

Leveraging the grant funding, Pitch Aeronautics has been able to design and build both the sensor and drone, testing the drone in a real-world simulated flight. Once this lab testing is complete, they plan to conduct further testing outside of the lab, and eventually, work with a customer to inspect infrastructure around the state. From the progress made through this grant, Pitch Aeronautics has been able to seek additional customers and funding, making their dreams a reality.

**“Our company would not be where it is without the help of the IGEM grant,” Ian Gibson, Pitch Aeronautics President and Co-founder said. “Through our partnership with IGEM and BSU, we have been able to design, construct and test our first cyclorotor drone prototype. Based on the progress we’ve made through the IGEM grant, we will be able to seek out additional customers and funding to take our prototype into production.”**



## WASHIE

With cleanliness and new ways of preventing the spread of germs and viruses at the top of everyone’s mind, there is no better time than the present for FY2019 IGEM-Commerce industry partner Washie — a company producing toilet seats with a built-in cleaning solution.

In 2019, Washie partnered with Idaho State University (ISU) to conduct testing on the functionality and efficacy of Washie’s patented sanitizing toilet seat.

Since receiving the grant, interest in the company has skyrocketed. Washie has already started installing its products in hospitals and other buildings throughout Boise and Southeast Idaho, and the toilet is quickly gaining traction across the nation.

Recently, 14 Washie toilet seats were installed in the Pocatello airport — the place where it all began. Washie has also expanded to Utah, where it will continue to grow and be installed in public facilities.

Robert Poleki, CEO and founder of Washie, said the company has seen a major increase in demand for its product with new expectations of cleanliness across the nation — making it difficult for the company to keep up with the high volume of demand.

**“We are still crawling before we start running, and it has been a unique year for us,” Poleki said. “It definitely allowed us to learn from our mistakes, but the future of the company is looking good. I want to thank IGEM for, not only the financial assistance but also the guidance they provided us along the way.”**



PHOTO COURTESY: WASHIE

WASHIE CREATES TOILETS WITH A BUILT-IN SANITIZING SOLUTION.

## IGEM COUNCIL

Membership of the IGEM Council includes:

- Four representatives from the private sector;
- One representative from the State Board of Education;
- One representative from the Idaho National Laboratory or the Center for Advanced Energy Studies;
- One representative each from Boise State University, Idaho State University and the University of Idaho;
- One representative from the Idaho Senate;
- One representative from the Idaho House of Representatives;
- And the Director of Idaho Commerce.

## FY2021 MEMBERS

**DR. DAVID HILL (CHAIR)** - STATE BOARD OF EDUCATION

**BILL GILBERT (VICE CHAIR)** - CAPROCK GROUP

**VON HANSEN** - KONEXUS

**RICK STOTT** - SUPERIOR FARMS

**DAMOND WATKINS** - STELVIO STRATEGIES

**DR. MARIANNE WALCK** - IDAHO NATIONAL LABORATORY

**DR. CHRISTOPHER NOMURA** - UNIVERSITY OF IDAHO

**DR. HAROLD BLACKMAN** - BOISE STATE UNIVERSITY

**DR. DONNA LYBECKER** - IDAHO STATE UNIVERSITY

**SENATOR KELLY ANTHON**

**REPRESENTATIVE PAUL AMADOR**

**TOM KEALEY** - DIRECTOR, IDAHO COMMERCE



PHOTO COURTESY: WASHIE

WASHIE’S PRODUCT IS GAINING RECOGNITION ACROSS IDAHO, WITH 14 TOILETS RECENTLY INSTALLED IN THE POCATELLO AIRPORT.



## IGEM-COMMERCE COMPLETED PROJECTS

LEARN MORE ABOUT IGEM-COMMERCE COMPLETED PROJECTS ON OUR WEBSITE  
[IGEM.IDAHO.GOV/COMPLETED-PROJECTS](http://IGEM.IDAHO.GOV/COMPLETED-PROJECTS)

YEAR	SCHOOL	PROJECT	AWARD
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
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 Pre-clinical 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

# IGEM-COMMERCE FY2021 GRANT AWARDS



## NOVEL METALLIC AND NANOMATERIAL COATINGS AND APPLICATION PROCESS FOR OPTICAL FIBERS AND SENSORS

**Boise State University**  
**Award Amount: \$130,970**

Together, Boise State University (BSU) and Fiber-guide, a Molex company, are working to research and develop a new coating technology for fiber optics and sensors in harsh environments. Both BSU and Fiber-guide, will work on the development of a metal-coated Fiber Bragg Grating (FBG) process for the aerospace, energy, oil and gas industries.



THE INFLEX LAB PROJECT WILL DEVELOP NANOMATERIAL INKS, LIKE THE ONE PICTURED.

## MULTI-PRINTER COMPATIBLE NANOPARTICLE INKS FOR ADVANCED MANUFACTURING METHODOLOGIES

**Boise State University**  
**Award Amount: \$196,324**

Boise State University (BSU) and industry partner, INFflex Labs, LLC, are set to develop nanomaterial inks for printed and flexible hybrid electronics. The intent is to create nanomaterial inks that can be used across a broad spectrum of printers for multiple applications such as flexible electronics, wearable technologies, sensors and more.

UNIVERSITY PARTNER	AWARD	PROJECT
Boise State University	\$291,770	PEF Potato Processing Advantage
University of Idaho	\$206,624	Testing New Manufacturing Methods of Natural Fiber Insulation Batts
Boise State University	\$196,324	Multi-Printer Compatible Nanoparticle Inks for Advanced Manufacturing Methodologies
Boise State University	\$130,970	Novel Metallic and Nanomaterial Coatings and Application Process for Optical Fibers and Sensors
<b>TOTAL</b>	<b>\$825,688</b>	

## FY2021 IGEN-COMMERCE SUPPLEMENTAL GRANT AWARDS

UNIVERSITY PARTNER	AWARD	PROJECT
University of Idaho	\$96,530	Development of an Advanced Genomic Selection Tool for the U.S. Sheep Industry
Boise State University	\$49,011	Development of a Scalable Manufacturing Process of On-Chip Color Tunable Lasers
Boise State University	\$49,011	Novel Movement and Inspection System for Drones
<b>TOTAL</b>	<b>\$194,552</b>	



Since their initial award, the project team has developed and tested three new ink systems in addition to their multi-printer platinum nanomaterials ink. Completed ink formulations and characterization for all three inks and multi-printer capability has been verified and the team developed Material Safety Data Sheets (MSDS), Standard Operating Procedures (SOP) and cost estimates for commercialization of inks.

Most recently, INFlex Labs launched a marketing campaign to advertise the new line of multi-printer inks including a new website, social media campaign and email campaign.



A RESEARCHER CONDUCTS A CHEMICAL ANALYSIS ON POTATO CHIPS.

## PEF POTATO PROCESSING ADVANTAGE

**Boise State University**  
**Award Amount: \$291,770**

Boise State University (BSU) and Food Physics Group will demonstrate the benefits of pulsed electric field (PEF) system applications for snack food production of potato and vegetable chips. This partnership will utilize equipment available from Elea Technology and be marketed by Food Physics Group, located in Boise.

Food Physics Group will optimize parameters for potato and vegetable chip processing to minimize reducing sugars, free amino acids and ultimately produce more competitive snack chips. Evaluation of processes to reduce energy and conserve water will provide sustainable practices for the snack food industry.

BSU will conduct chemical analysis of processed products and sampling during operating conditions to inform, guide and validate optimization parameters.

The project will allow Food Physics Group to increase sales of PEF systems, bringing more jobs to Idaho.

## TESTING NEW MANUFACTURING METHODS OF NATURAL FIBER INSULATION BATTS

**University of Idaho**  
**Award Amount: \$206,624**

The University of Idaho (UI) Integrated Design Lab and Idaho-based start-up company, Hempitecture, are collaborating to research and 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.

This partnership will enhance Hempitecture's product line and help them secure market power when they begin manufacturing these building products in Idaho in 2022. The project also provides university research students with hands-on experience in industry testing standards and equipment.



THE UI INTEGRATED DESIGN LAB CONDUCTS TESTS TO DETERMINE THERMAL CONDUCTIVITY.

## DEVELOPMENT OF AN ADVANCED GENOMIC SELECTION TOOL FOR THE U.S. SHEEP INDUSTRY

**University of Idaho**

**FY2020 Award Amount: \$251,114**

**FY2021 Supplemental Award Amount: \$96,530**

In FY2020, the University of Idaho (UI) and industry partner RILE Ag, received an IGEM-Commerce grant to advance a new genomic selection tool for the U.S. sheep industry.

The genome research will provide better tools and data for sheep ranchers and processors at a lower cost by changing genotyping assay platform to sequencing technology. In addition to being less expensive, this sequencing platform is also more flexible.

In FY2021, this project team received a supplemental grant, allowing the group to continue increasing the number of relevant genetic disease traits to increase the utility of the panel. The identification of the causative markers for these genetic diseases will be extremely valuable to the sheep industry.

The grant has enabled RILE Ag to increase engagement with producers, extension specialists and industry stakeholders.



BSU CONTINUES DEVELOPMENT OF A SCALABLE MANUFACTURING PROCESS FOR ON-CHIP TUNABLE LASERS.

## DEVELOPMENT OF A SCALABLE MANUFACTURING PROCESS FOR ON-CHIP COLOR TUNABLE LASERS

**Boise State University**

**FY2019 Grant Amount: \$242,114**

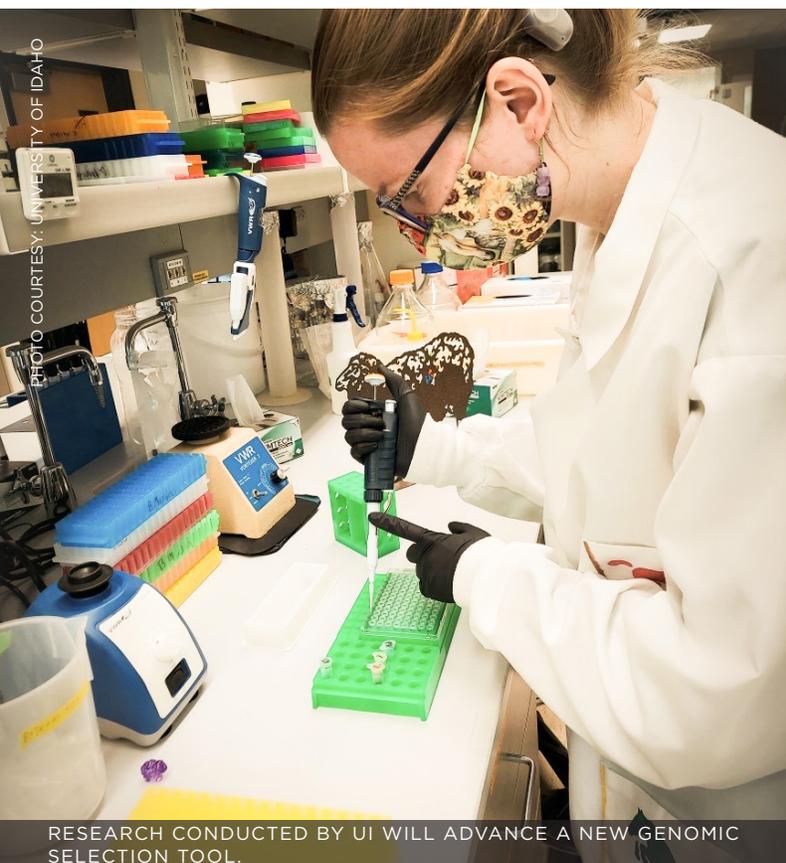
**FY2021 Supplemental Award Amount: \$49,011**

Boise State University (BSU) and industry partner, Iris Light Technologies, Inc. will continue development of a scalable manufacturing process for on-chip color tunable lasers.

The grant, awarded to BSU, helped Iris Light Technologies to create a scalable production method for black phosphorus by converting it from the readily available commodity red phosphorus, to render black phosphorus powder into a nanomaterial ink. The nanomaterial ink would then be printed on Iris Light Technologies foundry-produced hybrid silicon laser chips.

To date, this project has had many important accomplishments including the demonstration of effective production of photonic inks at a reduced cost, photo-detector devices from printed inks, black phosphorus ink purification and the alloying of black phosphorus. In addition, the project has resulted in two peer reviewed journal publications, five public conference presentations, a cooperative research agreement, the filing of a USPTO provisional patent, a graduate student internship at Micron Technologies Inc. and a supplement of over \$600,000 through external programs and private investments.

With the FY2021 supplemental grant, the research team plans to expand the current mechanochemical conversion, ink formulation and printing processes to simultaneously include the optimization of doping and alloying materials. This advances the widespread adoption of the technology by the silicon photonics industry.



RESEARCH CONDUCTED BY UI WILL ADVANCE A NEW GENOMIC SELECTION TOOL.

## NOVEL MOVEMENT AND INSPECTION SYSTEM FOR DRONES TO IMPROVE INFRASTRUCTURE SAFETY ASSESSMENT

**Boise State University**

**FY2020 Award Amount: \$248,083**

**FY2021 Supplemental Award Amount: \$49,011**

In FY2020, Boise State University (BSU) and industry partner, Pitch Aeronautics LLC, were awarded an IGEM-Commerce grant for research and development of the design, construction and demonstration of an inspection cyclorotor drone for up-close and touch based tasks, and the design and testing of an active thermography sensor.

To date, the research team has completed the design of the drone, drone controls model, the active thermography sensor, a drone test stand and deployment of code onto the drone. The team is currently working on iterative lab testing of the drone in order to begin flight testing. Pitch Aeronautics has also charged ahead on business development by submitting a non-provisional patent application on the drone configuration, receiving USPTO approval on a separate patent application, assisting in building a revenue stream for a partner company and submitting several government grant applications.

In FY2021, the research team was awarded supplemental funding to complete customer flight and sensor trials. It also enables incorporation of customer feedback into a revised design.



UI RESEARCH STUDENTS USE MUSTARD SEED MEAL AND FOOD HYDROLYSATE TO COMBAT ROUNDWORMS.

## IGEM-COMMERCE IN PROGRESS PROJECTS CONVERT AGRICULTURAL WASTE INTO AN EFFECTIVE NEMATODE SUPPRESSING FOOD AND FERTILIZER

**University of Idaho**

**FY2019 Award Amount: \$241,667**

Plant-feeding roundworms, or nematodes, are responsible for approximately \$100 billion in annual agricultural yield loss per year. Using IGEM-Commerce funding, the University of Idaho (UI) and California Safe Soils, are combining mustard seed meal with a food hydrolysate product to develop an affordable new biopesticide that can combat these roundworms while increasing yield and avoiding negative environmental consequences.

Experiments are underway to optimize the amounts and methods of pesticide application in the laboratory and greenhouse. Preliminary results show an impact on nematode populations and plant growth.

The project team hired a temporary study coordinator to complete a literature review and finalize the study design. In addition, the project team has begun to work on all the materials needed for gaining ethics approvals for the proposed clinical trial via the UI Institutional Review Board.



WITH CONTINUED RESEARCH AND TESTING, PITCH AERONAUTICS' DRONE IS CLOSE TO BECOMING A REALITY.

## FREE TO FEED FOOD ALLERGEN TEST KIT FOR HUMAN MILK

University of Idaho

FY2020 Award Amount: \$255,496

The University of Idaho (UI) and industry partner, Free to Feed Inc. are working together to advance Free to Feed's patent-pending technology that detects allergen proteins in human breast milk.

A total of 686 human milk samples were collected during the study. Thirty-eight of these human milk samples are from baseline collections prior to any dietary elimination or intervention. Over 300 human milk samples were collected post dietary elimination of soy-containing products and/or post dietary intervention of soy milk. Three hundred fifteen human milk samples were collected post dietary elimination of bovine milk-containing products and/or post dietary intervention of bovine.



PHOTO COURTESY: TRILLITYE PAULLIN

DR. TRILLITYE PAULLIN, FREE TO FEED FOUNDER, PICTURED, PARTNERED WITH UI TO DEVELOP HER TECHNOLOGY.

## DEVELOPMENT OF A RIBONUCLEIC ACID (RNA) HOME TEST FOR EARLY HIV DETECTION

Boise State University

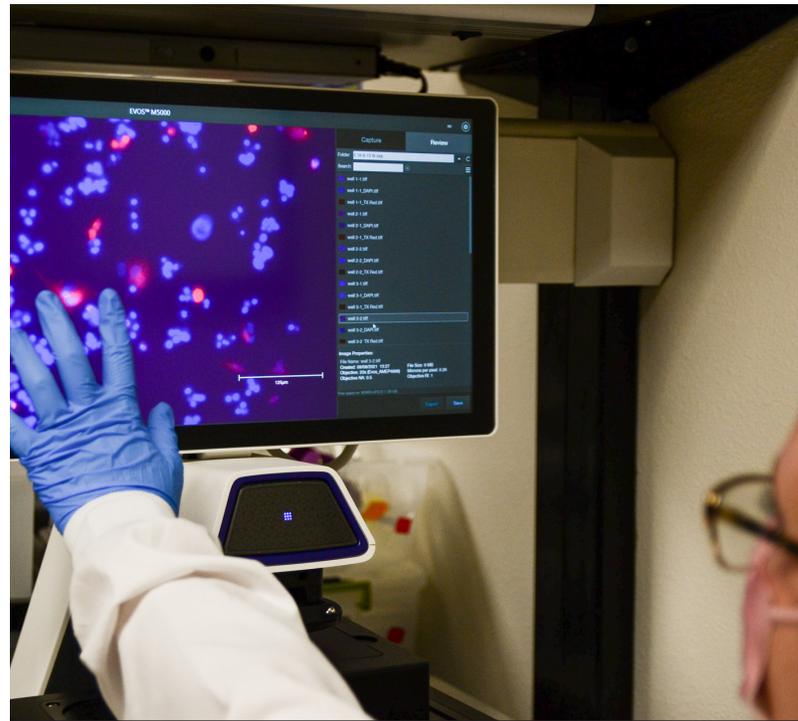
FY2019 Award Amount: \$255,496

Boise State University (BSU) and Molecular Testing Labs are collaborating to commercialize a ribonucleic acid (RNA) home test for early HIV detection.

The research conducted in this project will advance efforts in bringing to market a home test where, RNA

can be extracted from blood spots and provide HIV results in 7 to 10 days after infection, instead of 3 to 9 weeks.

Activities and research from this grant helped to develop viral expertise, which has led to two related federal grants for COVID-19 RNA detection, allowing three new employees to be hired. The project team is working with St. Luke's to obtain HIV positive serum from fresh blood (anonymized), to properly validate the in-lab HIV RNA findings.



BSU IS CONDUCTING RESEARCH TO COMMERCIALIZE RNA HOME TESTS.

## DEVELOPMENT IN OPTIMIZING LASER METAL DEPOSITION ADDITIVE MANUFACTURING TECHNIQUES

University of Idaho

FY2019 Award Amount: \$274,167

Through a collaboration with industry partner Premier Technology, Inc. (PTI) and Boise State University (BSU), the University of Idaho (UI) is optimizing a laser deposition-based additive manufacturing (3-D printing) technique to produce innovative products for the energy and food processing industries. This unique technique will allow users to quickly make large metallic parts with complex geometry and design flexibility under controlled atmospheric conditions.

The project will not only provide expertise in this area but also hands-on research experience to several students, supporting the development of the next

generation technical workforce in additive manufacturing. The project positions PTI as a leader by expanding their presence in the marketplace across Idaho and beyond.



LASER PRINTING A STAINLESS-STEEL PART UNDER REDUCED ATMOSPHERE.

## IGEM-HERC FY2021 GRANT AWARDS

IGEM-HERC (Higher Education Research Council) funds are used to support Idaho public institutions of higher education 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, 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.

## BOISE STATE UNIVERSITY FOOD AND DAIRY INNOVATION CENTER

**Boise State University**  
**Award Amount: \$684,000**

The vision of this project is to create a Food and Dairy Innovation Center (FDIC) at Boise State University (BSU). 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.

It is anticipated that the FDIC will spark economic development for all of Idaho. Objectives of this project are to create and advance new processing technologies, establish a robust employee pipeline from the university to the private sector and generate know-how and implementation of modern technology aimed at reducing usage of critical natural resources.

## THE CYBERDOME: AN INVESTMENT IN IDAHO'S FUTURE

**Boise State University**  
**Award Amount: \$700,000**

The Cyberdome is a Security as a Service (SECaaS) oriented platform meant to secure critical cyber and physical assets of rural and remote clients. Cybersecurity is at the forefront of national risk concerns today. If Idaho's geographically diverse infrastructure cannot be secured, it can quickly become dangerous, resulting in the loss of critical data, critical physical services or even lives.

The goal of this project is to cooperatively secure client community assets by engaging the best and brightest within the industry across the state, including cybersecurity leaders at the Idaho National Laboratory (INL), the State of Idaho, Idaho's universities and colleges, and private industry.

This project will create competency-based learning platforms for Idaho cybersecurity learners which provide a differentiated cyber workforce to employers, reduce critical cybersecurity risks for state, local, tribal and territorial (SLTT) clients and produce innovative research tools and techniques to transfer to commercial efforts.



## IGEM-HERC IN PROGRESS PROJECTS

### A DISASTER RESPONSE COMPLEX FOR EMERGENCY RESPONDERS IN IDAHO

**Idaho State University**  
**Award Amount: \$796,500**

There is currently a lack of an emergency response and training facilities in Idaho, and in the Western United States. Due to the lack of a local training center, responders from Idaho have had to be trained at the Center for Domestic Preparedness (CDP) in Anniston, Alabama, which is geographically and financially a burden.

The Disaster Response Complex (DRC) is an outdoor facility with rubble piles, collapsed structures, various materials, supplies, equipment and multiple “lanes” that allow for various mock-emergency scenarios to be re-created. It was built on the Idaho State University’s campus in Pocatello. This facility was designed to be used for all activities of the DRC including Chemical, Biological, Radiological, Nuclear (CBRN) research, certification and training.

Support from IGEM-HERC has made it possible to develop this DRC facility in southeast Idaho with the goal of having it be financially self-sustaining by the end of the third year (August 2022). The DRC has already hosted numerous training events for local and regional groups and agencies and will continue to grow and expand.

PHOTO COURTESY: IDAHO STATE UNIVERSITY



THE DISASTER RESPONSE COMPLEX PROVIDES RESEARCH, CERTIFICATION AND TRAINING FOR IDAHO EMERGENCY PROVIDERS.



PHOTO COURTESY: UNIVERSITY OF IDAHO

A RESEARCHER CONDUCTS TESTS ON A 3D PRINT.

## CELLULOSIC 3D PRINTING OF MODULAR BUILDING ASSEMBLIES

**University of Idaho**  
**Award Amount: \$546,000**

This project responds to a market need to increase construction labor productivity, labor skill sets and worker pay, as well as reduce or stabilize square foot material cost and decrease dependency on wood product imports.

The project team is trying to identify the methodology, process, and materials necessary to three-dimensional cold print (3D print) building assemblies, utilizing to some maximum extent, wood products.

The outcome of this research is the development of a reliable and cost-effective process for printing panels like wall, floor and roof assemblies, on a horizontal plane using a 3D printing process to produce a structural insulated panel. The proposal end goal is to build panels that are 10 feet wide by 16 to 20 feet in length that can be loaded onto a flatbed truck.

The team does not yet have private industry support for the project but are working toward a provisional patent and a new business model. They have been accepted into the I-Corps Ignite program which is providing a structured business development process. The University of Idaho (UI) College of Engineering has designed and built a prototype printer and have successfully printed single-layer prints. The refined goal for year three is to print in layers and build larger panels. Their resin and curing process has successfully produced a hardboard product that looks to be competitive with other hardboards on the market.

# IGEM-HERC COMPLETED PROJECTS

## SUSTAINING THE COMPETITIVENESS OF THE FOOD INDUSTRY IN SOUTHERN IDAHO: INTEGRATED WATER, ENERGY AND WASTE MANAGEMENT

**University of Idaho**  
**Award Amount: \$2,096,000**

Food production and processing has been, and will continue to be, vital to the social and economic integrity of the Eastern Snake River Plain. However, in some areas there are limits on both existing operations and growth due to water supply and water quality limits.

The purpose of this project was to contribute to the building capacity of the Food Processing Innovation and Education Center located at the University of Idaho.

This project builds capacity and partnerships among the three Idaho institutions (University of Idaho, Boise State University and Idaho State University) to assist Idaho food producers and processors in reducing water, energy and waste footprints.

PHOTO COURTESY: UNIVERSITY OF IDAHO



THE PURPOSE OF THIS HERC PROJECT WAS TO CONTRIBUTE TO THE BUILDING CAPACITY OF THE FOOD PROCESSING INNOVATION AND EDUCATION CENTER.

## NUCLEIC ACID MEMORY

**Boise State University**  
**Award Amount: \$1,995,900**

Nucleic acid memory has become a global conversation, a national investment, an industrial opportunity and a local strength in Idaho.

With support from the IGEM grant, the project team had a vision to prototype a digital data storage paradigm by designing, building and testing non-volatile nucleic acid memory (NAM) technologies that are inspired by DNA circuits and made possible by innovations in DNA nanotechnology. The focal point for this research was to prototype digital nucleic acid memory (dNAM), a storage medium where data is encoded into the physical address of DNA strands within a DNA origami breadboard.

During the award period, several products were created, including patents, journals, commentaries, news briefs, software packages, select presentations, dissertations and a company. Furthermore, the Nucleic Acid Memory (NAM) Institute at Boise State was invited to join the DNA Data Storage Alliance. The alliance is the first and most extensive bridge between industry and academic organizations that are pioneering DNA data storage. The alliance will recommend the creation of specifications and standards which enable end-users to add interoperable DNA-based storage solutions to their existing storage hierarchies.

## IGEM-CAES

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

PHOTO COURTESY: UNIVERSITY OF IDAHO



RESEARCH ON THIS HERC PROJECT ASSISTS FOOD PRODUCERS IN REDUCING WASTE.

## NUSCALE LAB OPENS AT CAES

A state-of-the-art NuScale power plant control room simulator made its debut at CAES in June, the culmination of extensive collaboration between INL, the CAES universities and NuScale. Expected to assist in training related to NuScale's small modular reactors (SMR) and with workforce development and outreach at CAES, the SMR Simulator Laboratory is the result of a \$285,000 Nuclear Energy University Program (NEUP) award to a University of Idaho-led project, "Multi Universities SMR Simulators: NuScale."

The project is one of three university-led projects that received a NEUP award aimed at broadening the understanding of advanced nuclear technology in a control-room setting and providing students, researchers, operators and members of the public opportunities to engage in STEM research and education. The new lab features a virtual nuclear power plant control room that enhances CAES' ability to inspire, train and educate the future energy workforce, expands opportunities for collaborative research between CAES and NuScale, and provides a valuable tool for educating the public about nuclear energy and reactor technology. Featuring an "Energy Exploration Center" that employs state-of-the-art computer modeling within a simulator of the control room of a NuScale SMR, the new lab allows users to assume the role of control room operator to learn about the innovative features and functionality unique to NuScale's SMR technology, demonstrating CAES' commitment to conducting cutting-edge energy research, educating the next generation of scientists and engineers and partnering with industry to advance competitiveness.



PHOTO COURTESY: CAES

NuScale's small modular reactor is the first to receive design approval from the US Nuclear Regulatory Commission, and tentative plans call for the 6-unit SMR plant, called the Carbon Free Power Project, to be constructed on INL's 890-square-mile desert site west of Idaho Falls. The reactors are expected to be commercially operational by the end of the decade.

## CAES SUMMER VISITING FACULTY PROGRAM WRAPS UP FOURTH YEAR

CAES's flagship program, the CAES Summer Visiting Faculty Program, concluded its fourth year in August. The program pairs university faculty and researchers throughout the summer, with the goal of developing a joint-funded research proposal of value to both parties, and is a cog in CAES' effort to enable the one-on-one collaborations needed to build and sustain a research collaboration ecosystem. The program provides university participants access to the national laboratory, allowing them to learn about its inner workings, capabilities and expertise, while building lasting networks between INL researchers and their students and colleagues. For INL researchers, the program offers an opportunity to build new academic connections, gain exposure to diversified funding opportunities and connect with faculty members. This year's cohort featured 14 research teams from the CAES universities and INL researchers.

Participants were selected based on proposals submitted by faculty in one of the CAES focus areas: nuclear energy, advanced manufacturing, cybersecurity, innovative energy systems, energy-water nexus, energy policy and computing, data and visualization.

## CAES LAUNCHES SECOND ANNUAL PITCH EVENT

CAES launched its second annual pitch competition in July. More than \$90,000 in CAES professional development funds were available to competitors in the 2021 CAES Annual Pitch Event, with the best ideas on how INL can advance its goal of net zero carbon emissions for operations at the national laboratory. Open to students, faculty and INL researchers, the competition is split into three tracks: projects that can help INL reduce its greenhouse gas emissions and be in place by 2024, those that are ready to be implemented within the next year and an open submission category. All contestants are eligible for training on how to more effectively pitch their ideas and research via CO\*STAR, RIIS and pitch coaching. By incorporating

a real-world problem set into the competition, the contest is intended to capitalize on the assets and resources of the CAES entities to develop ideas and capabilities in a disciplined manner. At the same time, the competition provides the CAES research community with training needed to effectively communicate technical ideas and solutions in short, dynamic and engaging presentations.

## **BOISE STATE UNIVERSITY GRANT LEADS TO NSF SITE AT CAES**

Boise State University (BSU) received a \$365,000 grant to launch a National Science Foundation Research Experience for Undergraduates (REU) site at CAES. The funding allows CAES to offer a 10-week summer research program for undergraduate students each year for three years, giving the students hands-on research experiences and networking opportunities to develop their STEM identity and literacy, while also providing professional development opportunities for careers in the energy sector.

Each summer, 10 students conduct research at CAES – five students from 2-year and 4-year institutions in Idaho and five students from a pool of applicants from across the nation. Faculty from Idaho State University (ISU) and the University of Idaho (UI) contributed to the proposal and will also mentor REU student projects at the CAES facility. A similar REU site has been in place for about a decade in the materials science department at Boise State and has proven to be an invaluable recruiting tool. During the summer camp, students will network with and learn from INL researchers, have opportunities to share their work with an active research community and co-author publications and presentations based on their research findings.

This project is funded by the Division of Engineering Education and Centers and the Established Program to Stimulate Competitive Research (EPSCoR).

## **CAES COLLABORATION FUNDS CONTINUE FOR FOURTH YEAR**

CAES “collaboration funds” were awarded to nine project teams led by INL researchers that include faculty from the CAES universities. The goal of this program, which is in its fourth year, is to establish and foster relationships between the CAES entities in research, education and innovation. Priority was given to projects with a tie to future direct-funded work such as through a DOE solicitation.

## **TEM PROJECT UPDATE**

The first phase of an INL-funded \$5 million project to install a new Transmission Electron Microscope (TEM) at the CAES facility, was completed in December.

The new microscope is more technologically advanced than any of the current TEM resources across the CAES complex and is expected to be the centerpiece of a planned advanced manufacturing suite at CAES. Advanced manufacturing is one of seven focus areas identified in the CAES strategy, and the TEM will advance collaborative research, education and innovation in this focus area in several ways, including advancing the timeline for nuclear innovation and the acceleration of modeling efforts needed to advance the discovery and qualification of materials for nuclear applications. It also will allow for the investigation of defects in functional energy materials found in batteries with atomic precision – a key step in improving battery performance that will help CAES advance its efforts to develop the next generation of energy workers. As a Nuclear Science User Facilities (NSUF) laboratory, the new advanced manufacturing suite will be accessible to students and faculty at the CAES universities and to researchers all over the world. The ease of access of CAES not only applies to students, faculty and private industry but also to INL, particularly its Advanced Design and Manufacturing initiative. The TEM is INL’s latest investment in CAES that is designed to create opportunities for collaborative research.

## **CAES, ATR TEAM UP**

Several CAES faculty members and leadership at INL’s Advanced Test Reactor (ATR) started initial discussions earlier this year on ways to collaboratively engage students in understanding ATR’s world-class capabilities. The discussions center on providing students access to the Advanced Test Reactor Critical (ATRC) facility and the ATR gamma tube to conduct experiments and observe operations. Although a mechanism for collaboration has not been determined, plans for a “pilot opportunity” are under development. The talks began in fall of 2020, and resumed in January and February, with representatives from each of the CAES universities visiting ATR this summer.

Several CAES faculty members, Idaho State University Professor Dan LaBrier, Boise State University Professor Brian Jaques and University of Idaho Professor Rich Christensen, have agreed to participate in the pilot opportunity. ATR’s team is assembling a test plan and user guide to share with faculty.

ATRC, which has been operating since 1964, has traditionally been used to verify the safety of a proposed experiment before it is placed in the ATR. Recent improvements in experiment modeling are expected to lessen the reliance on ATRC for pre-ATR testing, leading to capacity in ATRC and opportunity for students.

## IDAHO I-CORPS IGNITE FINAL EVENT HELD

Faculty, research staff and graduate students from the CAES universities participated in the four-week

Idaho I-Corps Ignite summer program, which culminated in July with a “Demo Day” where teams shared their ideas. Sponsored by CAES, the pilot program was designed to help participants commercialize their research, filling a gap in commercialization and entrepreneurship resources for faculty from the three CAES universities. Idaho I-Corps Ignite focused on scalable ventures, offered a stipend for participants, provided introductions to a network of mentors and helped refine solutions into ventures through research, customer discovery and idea validation.

## CAES BY THE NUMBERS



### Investments:

**3**

**\$3 million**  
State of Idaho investment in CAES.

**12.3**

**\$12.3 million\***  
Idaho National Laboratory funding which includes:

**1**

**\$1 million\***  
Advanced manufacturing suite.

**4.6**

**\$4.6 million\***  
Transmission electron microscope.

\*INL numbers are for FY2021: Oct. 1, 2020 - Sept. 30, 2021.

### Outreach and Student Impact:

**105**

**105 students** from CAES affiliated universities interned at Idaho National Laboratory.\*

**15**

**15 faculty members** from CAES affiliated universities have joint appointments with Idaho National Laboratory.\*

**256**

**256 INL employees** took courses at Idaho's public research universities in FY2021.\*

**12**

**12 faculty members** from CAES affiliated universities participated in the fourth annual CAES Summer Visiting Faculty Program.

**3**

**3 students** from CAES affiliated universities began postdoctoral appointments at Idaho National Laboratory.\*

**11**

**11 students** from CAES affiliated universities were offered graduate fellowships at Idaho National Laboratory.\*

**12**

**12 INL interns** from CAES affiliated universities in FY2021 transferred to either full-time positions or subcontract positions at INL at the conclusion of their internship.\*

---

## PARTNERS



**IGEM**

### IGEM – COMMERCE

Idaho Department of Commerce

700 W State Street  
Boise, Idaho 83702  
(208) 334-2470  
[igem.idaho.gov](http://igem.idaho.gov)



**BOISE STATE  
UNIVERSITY**

### BOISE STATE UNIVERSITY

Division of Research and Economic Development

1910 University Drive  
Boise, Idaho 83725  
(208) 426-5732  
[boisestate.edu/research](http://boisestate.edu/research)



### IGEM – HERC

Idaho State Board of Education

650 W State Street 3rd Floor  
Boise, Idaho 83702  
(208) 334-2270  
[boardofed.idaho.gov](http://boardofed.idaho.gov)



**University  
of Idaho**

### UNIVERSITY OF IDAHO

Office of Research and Economic Development

875 Perimeter Drive MS 3010  
Moscow, Idaho 83844  
(208) 885-6689  
[uidaho.edu/research](http://uidaho.edu/research)



### IGEM – CAES

Center for Advanced Energy Studies

995 MK Simpson Blvd.  
Idaho Falls, Idaho 83401  
(208) 526-9676  
[caes.org](http://caes.org)



**Idaho State  
University**

### IDAHO STATE UNIVERSITY

The Office for Research

1651 Alvin Ricken Drive MS 8064  
Pocatello, Idaho 83201  
(208) 282-2592  
[isu.edu/research](http://isu.edu/research)



**IGEM**

800.842.5858 | [info@commerce.idaho.gov](mailto:info@commerce.idaho.gov) | [commerce.idaho.gov](http://commerce.idaho.gov)