CAES Associate Director Tri-Annual Report

January – May 2025

Executive Summary

In March 2025, Idaho State University worked with Idaho National Laboratory (INL) and has added a subtopic "Development and Deployment of Advanced Nuclear Reactors" under the 2nd focus area (Energy-Environmental Security) in the Strategic Understanding for Premier Education and Research (SUPER) Agreement, refer to the Section 12 for more information. Other subtopics for each focus area were also identified, these will be developed and defined by the researchers from the two entities over the next several months. Current preparation is underway for an INL workshop day at ISU in the Fall 2025 and online/in person discussions (researcher-to-researcher) to develop and define the subtopics and focus areas in the SUPER Agreement. ISU has created a webpage for the SUPER Agreement with INL (https://www.isu.edu/research/industry/super-agreement/) where regular updates will be posted. ISU had new Joint Appointments with INL in the areas outlined in the ISU-INL SUPER Agreement.

Between January 1st – May 12th 2025, ISU CAES researchers submitted at least 22 proposals with a total amount of approximately $12M from which nearly $1.9M was funded. Furthermore, the researchers had 28 peer-reviewed articles published, 7 accepted for publication, two submitted, and three under review (total of 40 publications), two published abstracts, two conference posters, and two filed/in preparation patents. ISU CAES researchers presented collaborative research in 8 regional, national, and international conferences.

In April 2025, Idaho State University (ISU) and Universidad de Ingeniería y Tecnología (UTEC) in Peru signed a memorandum of understanding for strategic research collaboration. The MoU focuses on Energy-Environmental Security which is one of the two focus areas in the recently signed ISU-INL SUPER Agreement.

ISU has formed collaboration with industry such as Ashvalor, Oldcastle Infrastructure, Simpson Strong-Tie, and Wilbert Precast. ISU is currently pursuing significant grants from different agencies in collaboration with INL and these industry champions. Additionally, ISU facilitated new conversation among different group at INL on geothermal energy, reactor analysis and design, international materials, and other areas.

 # Tours Led by University Reps: ≈ 10

#People Attended: ≈ 20-30

Section 1. University Publications on behalf of CAES

Title: Tight Approximation of Achievable Rates in RIS-Based Multi-User MIMO Systems Under Channel Estimation Constraints

Journal: IEEE Open Journal of the Communications Society, vol. 6, pp. 1299-1327, Feb. 2025

Authors: Samar I. Farghaly, Mohamed I. Ismail, Mostafa M. Fouda, and Ahmed S. Alwakeel

Status: Published, DOI: 10.1109/OJCOMS.2025.3539229

Title: Deep Learning Approach for Cable Partial Discharge Pattern Identification

Journal: Springer Electrical Engineering, vol. 107, 1525–1540, Feb. 2025

Authors: Mohamed H. Saad, Sherief Hashima, Ahmed I. Omar, Mostafa M. Fouda, and Abdelrahman Said

Status: Published, DOI: 10.1007/s00202-024-02571-w

Title: Securing One-Class Federated Learning Classifiers Against Trojan Attacks in Smart Grid

Journal: IEEE Internet of Things Journal, vol. 12, no. 4, pp. 4006–4021, Feb. 2025

Authors: Atef H. Bondok, Mahmoud Badr, Mohamed Mahmoud, Mohamed Abdullah, Mostafa M. Fouda, and Mohamed Abdullah
Status: Published, DOI: 10.1109/JIOT.2024.3481213

Title: Concept Drift Aware Wireless Key Generation in Dynamic LiFi Networks
Journal: IEEE Open Journal of the Communications Society, vol. 6, pp. 742–758, Jan. 2025
Authors: Elmahedi Mahalal, Eslam Hasan, Muhammad Ismail, Zi-Yang Wu, Mostafa M. Fouda, Zubair Md Fadlullah, and Nei Kato
Status: Published, DOI: 10.1109/OJCOMS.2024.3524497

Title: Revolutionizing User Authentication Exploiting Explainable AI and CTGAN-based Keystroke Dynamics
Journal: IEEE Open Journal of the Computer Society, vol. 6, pp. 97–108, Jan. 2025
Authors: Hussien AbdelRaouf, Mostafa M. Fouda, and Mohamed I. Ibrahem
Status: Published, DOI: 10.1109/OJCS.2024.3513895

Title: Security and Privacy for LLMs and LMMs Across Key Sectors: A Literature Survey
Conference presentations: Proc. of the 2025 International Conference on Information Technology: New Generations (ITNG 2025), Las Vegas, Nevada, USA, Apr. 27–29, 2025
Authors: Costain Nachuma, Mostafa M. Fouda, and Minhaz F. Zibran
Status: Published

Title: GPU VS. CPU: A Comparative Study of Performance, Architecture, and NVIDIA's Innovations in Modern Computing
Conference presentations: Proc. of the 2025 International Conference on Computing and Machine Intelligence (ICMI 2025), Mt. Pleasant, MI, USA, Apr. 5–6, 2025
Authors: Quazi Rian Hasnaine, Mostafa M. Fouda, and Steve C. Chiu
Status: Published

Title: A Comprehensive Review on Real-Time Vehicle and Pedestrian Detection Using YOLO
Conference presentations: Proc. of the 2025 International Conference on Computing and Machine Intelligence (ICMI 2025), Mt. Pleasant, MI, USA, Apr. 5–6, 2025
Authors: Shijon Das, Mohamed I. Ibrahem, and Mostafa M. Fouda
Status: Published

Title: Deep Learning-Based Physical Layer Authentication in LiFi Networks Under Multi-User Mobility
Conference presentations: Proc. of the 2025 IEEE SoutheastCon 2025, Charlotte, NC, USA, Mar. 22–30, 2025
Authors: Elmahedi Mahalal, Eslam Hasan, Muhammad Ismail, Zi-Yang Wu, Mostafa M. Fouda, and Zubair Md Fadlullah
Status: Published

Title: Emerging Trends in AI-Powered IoT: Innovations, Key Challenges, and Future Directions

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Conference presentations: Proc. of the 2025 IEEE SoutheastCon 2025, Charlotte, NC, USA, Mar. 22–30, 2025
Authors: Hussien AbdelRaouf, Mahmoud Abouyoussef, Mostafa M. Fouda, Zubair Md Fadlullah, and Mohamed I. Ibrahem
Status: Published

Title: A Comprehensive Survey of Model Extraction Attacks: Current Trends, Defenses, and Future Directions
Conference presentations: Proc. of the 2025 1st IEEE Conference on Secure and Trustworthy CyberInfrastructure for IoT and Microelectronics (SaTC 2025), Fairborn, Ohio, USA, Feb. 25–27, 2025
Authors: Quazi Rian Hasnaine, Yaodan Hu, Mohamed I. Ibrahem, and Mostafa M. Fouda
Status: Published

Title: Few-Shot Learning for CPS Anomaly Detection: A Survey on Smart Grid Applications
Conference presentations: Proc. of the 2025 1st IEEE Conference on Secure and Trustworthy CyberInfrastructure for IoT and Microelectronics (SaTC 2025), Fairborn, Ohio, USA, Feb. 25–27, 2025
Authors: Chowdhury Tasnuva Hazera, Mohamed I. Ibrahem, and Mostafa M. Fouda
Status: Published

Title: Privacy-Preserving Secure Framework for Intelligent Transportation Systems
Conference presentations: Proc. of the 2025 1st IEEE Conference on Secure and Trustworthy CyberInfrastructure for IoT and Microelectronics (SaTC 2025), Fairborn, Ohio, USA, Feb. 25–27, 2025
Authors: Yuka Nagayoshi, Sharif Ullah, Bernard Chen, Mohamed I. Ibrahem, Mostafa M. Fouda, and Mahmoud Abouyoussef
Status: Published

Title: Nutrient recovery from wastewater using an algae cultivator coupled with a single-chamber microbial fuel cell and ceramic membrane interface
Journal/conference presentations: Bioresource Technology (journal)
Authors: Sato, C., Alikaram, G., Apollon, W., Dudgeon, J., Kolajo, O. O., Kamaraj, S-K.
Status: Submitted
Title: Numerical Investigation on the Potential Use of Different Liquid Metals for the MARVEL-IHX
Journal/conference presentations: American Nuclear Society (ANS 2025) Annual Meeting
Authors: Sutapa Biswas, Scott Wahlquist, Eslam Ali, Amir Ali
Status: Accepted (will be presented in June 2025)

Title: Analysis of Oval Twisted Helical Tube Heat Exchanger with RELAP5-3D: Effect of Oscillating Wall Temperature.
Journal/conference presentations: American Nuclear Society (ANS 2025) Annual Meeting
Authors: Scott Wahlquist, Ahmed Hamed, Piyush Sabharwall, George Mesina, Palash Bhowmik, Amir Ali
Status: Accepted (will be presented in June 2025)

Title: Development of novel oval-twisted helical tube once-through steam generator: Part I: Single-phase laminar flow
Journal/conference presentations: Progress in Nuclear Energy Journal, 183, 105667
Authors: Scott Wahlquist, Amir Ali, Kyle Schroeder, SuJong Yoon, Piyush Sabharwall
Status: Published

Title: Dynamic Behavior of Oval-Twisted Helical Tube Heat Exchanger: Numerical Study using RELAP5-3D
Journal/conference presentations: Journal of Nuclear Technology
Authors: Scott Wahlquist, Ahmed Hamed, Palash Bhowmik, Piyush Sabharwall, George Mesina, Amir Ali
Status: Under review

Title: GreekNet: Handwritten Greek Alphabet Recognition Using Explainable Parallel CNN with Attention Mechanisms
Journal/conference presentations: 4th International Conference on Computing and Machine Intelligence
Authors: A. Efat, S. Hasan, and M. Zibran
Status: Published

Title: Chasing the Clock: How Fast Are Vulnerabilities Fixed in the Maven Ecosystem?
Journal/conference presentations: 22nd IEEE International Conference on Mining Software Repositories
Authors: M. Rabbi, A. Champa, R. Paul, and M. Zibran
Status: Published

Title: Insights into Dependency Maintenance Trends in the Maven Ecosystem
Journal/conference presentations: 22nd IEEE International Conference on Mining Software Repositories
Authors: B. Chowdhury, M. Rabbi, S. Hasan, and M. Zibran
Status: Published

Title: The Popularity Paradox: Insights into Vulnerabilities and Updates in Maven Ecosystem
Journal/conference presentations: 8th International Conference on Software and System Engineering
Authors: M. Bhuiyan, M. Rabbi, S. Hasan, and M. Zibran
Status: Published

Title: Decoding Dependency Risks: A Quantitative Study of Vulnerabilities in the Maven Ecosystem
Journal/conference presentations: 22nd IEEE International Conference on Mining Software Repositories
Authors: C. Nachuma, M. Hossan, A. Turzo, and M. Zibran
Status: Published

Title: Faster Releases, Fewer Risks: A Study on Maven Artifact Vulnerabilities and Lifecycle Management
Journal/conference presentations: 22nd IEEE International Conference on Mining Software Repositories
Authors: M. Shafin, M. Rabbi, S. Hasan, and M. Zibran
Status: Published

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Title: Understanding Software Vulnerabilities in the Maven Ecosystem: Patterns, Timelines, and Risks
Journal/conference presentations: 22nd IEEE International Conference on Mining Software Repositories
Authors: M. Rabbi, R. Paul, A. Champa, and M. Zibran
Status: Published

Title: Insights into Vulnerability Trends in Maven Artifacts: Recurrence, Popularity, and User Behavior
Journal/conference presentations: 22nd IEEE International Conference on Mining Software Repositories
Authors: C. Bodily, E. Hill, A. Kramer, L. Kerby, and M. Zibran
Status: Published

Title: An Advanced Ensemble Approach for Efficient Skin Lesion Classification with Stacked RegNet Fusion and Attention-Triad
Journal/conference presentations: PLOS ONE Journal
Authors: A. Efat, S. Hasan, and M. Zibran
Status: Submitted

Title: Let There be Light: Photo-Induced Reaction Synthesis—Advancing Manufacturing Horizons.
Journal/conference presentations:
Authors: Shanae M. Brachtl, Rene G. Rodriguez, and Kiyo Fujimoto
Status: Pending

Title: Seismic Performance of Conventional and Additively Manufactured U-Shaped Flexural Plates Manufacturing
Journal/conference presentations: IABSE Congress Ghent 2025 – The Essence of Structural Engineering for Society
Authors: Kshitiz Risal, Kunal Mondal, Jared Cantrell, Tadesse G. Wakjira, Mustafa Mashal
Status: Accepted

Title: A Comparative Seismic Performance Assessment of Metallic Dissipaters Made of Mild Steel, Aluminum, and Titanium Alloys
Journal/conference presentations: Journal of Structural Design and Construction Practice, ASCE
Authors: Saksham Raj Maharjan, Tadesse G. Wakjira, and Mustafa Mashal
Status: Accepted

Title: Can We Trust AI Content Detection Tools for Critical Decision Making?
Journal/conference presentations: Frontiers in Artificial Intelligence - Natural Language Processing, Frontiers
Authors: Wakjira T., Tijani I., Alam MS., Mashal M., Hasan K.
Status: Under review

Title: Cyclic Loading Performance of U-Shaped Flexural Plates: A Comparative Analysis of Conventional and Additive Manufacturing Methods using 316L Stainless Steel

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Conference Presentation: International Association for Bridge and Structural Engineering (IABSE) Congress, Ghent, Belgium
Authors: K. Raisal, K. Mondal, J. Cantrell, T. Wakjira, and M. Mashal
Status: Accepted

Title: Pull-Out Testing of Titanium Alloy Bars in Near-Surface Mounted Retrofitting of Concrete Structures
Conference Presentation: International Association for Bridge and Structural Engineering (IABSE) Congress, Ghent, Belgium
Authors: J. Cantrell, S. Arnold, and M. Mashal
Status: Accepted

Title: Comparative Analysis of Confined and Unconfined UHPC Column under Axial Loading
Conference Presentation: New Zealand Society for Earthquake Engineering Conference, Auckland, New Zealand
Authors: M. Acharya, T. Wakjira, and M. Mashal
Status: Published

Title: Behavior of Ultra-High Performance Concrete Confined with Circular Titanium Alloy Ties.
Conference Presentation: Challenges and Innovations for Sustainable Smart Cities. Chandigarh, India
Authors: M. Acharya, T. Wakjira, and M. Mashal
Status: Published

Title: Use of Dairy Wastewater in Concrete: A State-of-the-Art Review
Conference Presentation: Challenges and Innovations for Sustainable Smart Cities. Chandigarh, India
Authors: S. Rajbhandari, K. Sharma, T. Wakjira, and M. Mashal
Status: Published

Title: Sustainable Concrete with Dairy Wastewater: A State-of-the-Art Review
Conference Presentation: International Association for Bridge and Structural Engineering (IABSE) Symposium, Tokyo, Japan
Authors: S. Rajbhandari, P. Bhattarai, K. Sharma, T. Wakjira, J. Cantrell, and M. Mashal
Status: Published

Title: Stress-Strain Response of Confined Green Concrete
Conference Presentation: International Association for Bridge and Structural Engineering (IABSE) Symposium, Tokyo, Japan
Authors: P. Bhattarai, T. Wakjira, J. Cantrell, and M. Mashal
Status: Published

Title: Study on Confinement of Ultra-High Performance Concrete Using Ties
Conference Presentation: International Association for Bridge and Structural Engineering (IABSE) Symposium, Tokyo, Japan
Authors: M. Acharya, T. Wakjira, and M. Mashal

Updated 2/29/24 SK

Status: Published

Title: Experimental and Data-Driven Evaluation of the Bond Strength Between UHPC And Titanium Alloy Reinforcing Bars
Journal: Structures
Authors: M. Acharya, L. Bedriñana, and M. Mashal
Status: Under review

Title: Laboratory Evaluation of Glass Fiber Reinforced Polymer (GFRP) Bars to Improve Joints in Natural Fiber Reinforced Concrete (NFRC) Pavements
Conference Presentation: Idaho State University Research and Creative Works Symposium, Pocatello, ID, United States
Authors: S. Dotel, T. Ahmed, M. H. Yassin, M. Mashal, and M. Acharya
Status: Presented (Poster)

Title: Precast Concrete Engineering Studio
Conference Presentation: PCI Convention and Precast Show, Indianapolis, IN, United States
Authors: T. Wakjira, M. Mashal, and B. Savage
Status: Presented (Poster)

Title: Explainable Machine Learning-based Novel Seismic Performance-Based Design and Vulnerability Assessment of UHPC Bridge Columns
Conference Presentation: Second Annual Digital Engineering Conference, Idaho Falls, Idaho, United States
Authors: T. Wakjira, S. Alam, and M. Mashal
Status: Accepted (Abstract only)

Title: Advancing Structural Resilience with Novel Materials: Titanium Alloy Reinforced Ultra-High-Performance Concrete (TARUHPC)
Conference Presentation: 1st Symposium on Climate-Smart Infrastructure Innovations & Implementation (CSI3)
Authors: M. Acharya, J. Cantrell, M. Mashal, and T. Atkinson
Status: Published (Abstract only)

Title: Novel Materials for Enhanced Dam Infrastructure: Titanium Alloys and Ultra-High-Performance Concrete in Construction and Retrofit Applications
Conference Presentation: 32nd FEMA National Dam Safety Program Technical Seminar, Emmitsburg, Maryland, United States
Authors: M. Acharya, J. Cantrell, and M. Mashal
Status: Published (Abstract only)

Section 2. Conferences Attended on behalf of CAES

Name: TMS Conference (Mining, Manufacturing, and Materials Conference)
Location: Las Vegas, NV

Purpose: Poster Presentation
Attendees from university/CAES: Rene Rodriguez, Adam Storms (undergrad student presenter)

Name: Third Technical Workshop on Nondestructive Evaluation (NDE) of Advanced Manufacturing (AM) Components
Location: Pacific Northwest National Laboratory, Richland, WA, USA
Purpose: Presentation
Attendees from university/CAES: Tadesse G. Wakjira

Name: 2025 PCI Convention and Precast Show
Location: Indianapolis, Indiana, USA
Purpose: Attendance and poster presentation
Attendees from university/CAES: Tadesse G. Wakjira, Jared Cantrell, Mustafa Mashal

Name: Transportation Research Board Annual Meeting
Location: Washington, D.C.
Purpose: Opportunities for collaboration in the areas of advanced materials and environmental security.
Attendees from university/CAES: Mustafa Mashal

Name: New Zealand Society for Earthquake Engineering Conference
Location: Auckland, New Zealand
Purpose: Networking, international collaboration, presenting ISU research in the areas of advanced materials, innovative concrete, and resiliency
Attendees from university/CAES: Mustafa Mashal

Name: University of Engineering and Technology (UTEC) XII Regional Forum of Civil Engineering Students
Location: Lima, Peru
Purpose: Keynote (Mustafa Mashal), seminars, and signing an MoU between UTEC and ISU for international research collaboration
Attendees from university/CAES: Mustafa Mashal, Martin Blair

Name: Oregon Department of Transportation Bridge, Geotechnical Engineering, Engineering Geology, and HazMat Design Training
Location: Keizer, OR
Purpose: Plenary Speaker (Mustafa Mashal), networking with industry in the area of environmental security and deployment of innovative concrete in infrastructure projects
Attendees from university/CAES: Mustafa Mashal

Name: International Association for Bridge and Structural Engineering (IABSE) Symposium
Location: Tokyo, Japan
Purpose: International collaboration, presenting ISU research in the areas of environmental security and resilience
Attendees from university/CAES: Mustafa Mashal, Jared Cantrell

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Sections 3. University Proposals Related to CAES Activities (see attached table)

Section 4. Patents, Licenses, other IP

Mashal M., Rizal K., Wakjira T., Cantrell J., Mondal K. (2025). "Additively Manufactured Energy Dissipaters (AMED)," status: Pending

M. Mashal, J. Mahar, K. Mondal, K. Phuyal (2025). "Eco-Friendly Concrete and Soil Cement Utilizing Waste Products", United States Patent and Trademark Office, 63/638,006.

Section 5. Grants and Awards

Title: A Sustainable AI-Powered Low-Carbon Emission Concrete (SCALE Concrete): Leveraging Agricultural Byproducts and Wastewater for Circular Economy Solutions (PI = Tadesse Wakjira)
Awarding Organization/Institution: HERC-IGEM
Timeframe (if applicable): 2025 - 2028
Award Amount: 547,011

Title: AI/ML Tool for Correlating Litho/Wireline Logs in Support of Mining, Conversion, and Transportation (PI = Mostafa Fouda)
Awarding Organization/Institution: Battelle Energy Alliance (BEA)
Timeframe (if applicable): Apr. 2025 – Sept. 2025
Award Amount: $50,742

Title: Advanced Compact and Efficient Heat Exchanger Technology (PI = Amir Ali)
Awarding Organization/Institution: HERC-IGEM
Timeframe (if applicable): 07/2025-06/2026
Award Amount: $125,000

Title: IDE-Integrated Interactive Software Visualization Superimposed on Inheritance Hierarchy (PI = Minhaz Zibran)
Awarding Organization/Institution: CAES Seed Grant
Timeframe (if applicable): Sept 2024 – June 2025
Award Amount: $15,000

Title: Toward Effective Security Defect Fixing through Peer Code Reviews (PI = Minhaz Zibran)
Awarding Organization/Institution: ISU ISGP
Timeframe (if applicable): Jan 2025 – Jan 2026
Award Amount: $5,000

Title: Analyzing the Threats and Defense Tactics in Collaborative Mixed Reality (CMR) Virtual Environments (PI = Minhaz Zibran)
Awarding Organization/Institution: ISU ISGP
Timeframe (if applicable): Dec 2024 – June 2025

Award Amount: $5,998

Section 6. Incoming CAES Personnel

Name: Mohamed Ismail, PhD Student
Institution: Idaho State University
Focus of work: Computer Science / Computer Engineering (Supervisor = Dr. Mostafa Fouda)

Name: Rhana Elsayed, PhD Student
Institution: Idaho State University
Focus of work: Computer Science / Computer Engineering (Supervisor = Dr. Mostafa Fouda)

Name: Sameer Budhathoki, Undergraduate Student
Institution: Idaho State University
Focus of work: Civil Engineering (Supervisor = Dr. Mustafa Mashal)

Name: Rakesh Itani, Masters Student
Institution: Idaho State University
Focus of work: Computer Science (Supervisor = Dr. Emanuele Zappala)

Section 7. Outgoing CAES Personnel

Name: Shijon Das, Masters Student
Institution: Idaho State University
Focus of work: Computer Science / Computer Engineering (Supervisor = Dr. Mostafa Fouda)

Name: Shanae Brachtl, Uundergraduate student
Institution: Idaho State University
Focus of work: Chemistry (Supervisor = Dr. Rene Rordriguez)

Name: Anjan Koirala, Master Student
Institution: Idaho State University
Focus of work: Civil Engineering (Supervisors = Dr. Mahesh Acharya and Dr. Mustafa Mashal)

Name: Samjhana Rajbhandari, Master Student
Institution: Idaho State University
Focus of work: Civil Engineering (Supervisors = Dr. Tadesse Wakjira and Dr. Mustafa Mashal)

Name: Manish Acharya, Master Student
Institution: Idaho State University
Focus of work: Civil Engineering (Supervisors = Dr. Tadesse Wakjira and Dr. Mustafa Mashal)

Name: Pawn Bhattarai, Master Student
Institution: Idaho State University
Focus of work: Civil Engineering (Supervisors = Dr. Tadesse Wakjira and Dr. Mustafa Mashal)

Name: Kshitiz Raisal, Master Student
Institution: Idaho State University
Focus of work: Civil Engineering (Supervisors = Dr. Tadesse Wakjira and Dr. Mustafa Mashal)

Section 8. Industry Engagement

Name: Mostafa Fouda (ISU)
Company: Ur-Energy Inc.
Project Focus: Uranium mining in situ recovery (ISR)

Name: Rene Rodriguez, Sri Pashikanti, Andy Holland, Robert Fox (INL)
Company: Simplot
Project Focus: Follow-up to meeting in January set up by the Office for Research, to develop relationship with Simplot for possible analysis of production streams to measure critical materials and other valuable material content for possible recovery, potential for writing a grant with INL, ISU and Simplot

Name: Rene Rodriguez, Sri Pashikanti, Robert Fox (INL), Paul Burt
Company: Ashvalor
Project Focus: Follow-up to meeting set up by Office for Research to develop relationship Ashvalor to provide analysis support for developing a new process related to insulation

Name: Mustafa Mashal and Jared Cantrell (ISU/INL)
Company: Simpson Strong-Tie
Project Focus: R&D for seismic resilience and retrofitting of structures

Name: Mustafa Mashal and Jared Cantrell (ISU/INL)
Company: Oldcastle Infrastructure
Project Focus: Environmental security / precast concrete & modular construction

Name: Mustafa Mashal and Jared Cantrell (ISU/INL)
Company: Wilbert Precast
Project Focus: Environmental security / precast concrete & modular construction

Name: Mustafa Mashal and Jared Cantrell (ISU/INL)
Company: Blue Planet Systems
Project Focus: Environmental security / innovative concrete

Name: Mustafa Mashal and Jared Cantrell (ISU/INL)
Company: Safe & Green Development Corp
Project Focus: Environmental security / innovative concrete

Name: Mustafa Mashal, Tadesse Wakjira, Mahesh Acharya, and Jared Cantrell (ISU/INL)
Company: Amalgamated Sugar Company
Project Focus: Environmental security / innovative cementitious materials

Name: Mustafa Mashal, Mahesh Acharya, Jared Cantrell (ISU/INL)
Company: Ashgrove Cement Company
Project Focus: Environmental security / innovative cementitious materials

Section 9. New Equipment
None.

Section 10. Collaborative Research Events
Name: Ur-Energy
Date: March 2025
Location: Willow Creek, WY
Attendees: Mostafa Fouda (ISU) and researchers from INL/other national laboratories
Results/Impact: Collaboration on uranium mining in situ recovery (ISR).

Name: Idaho National Laboratory Leadership Visit to ISU
Date: February 2025
Location: Pocatello, ID
Attendees: John Wagner, Todd Combs, Eric Papaioannou (INL)
Results/Impact: Meet and greet with ISU leadership, information sessions with faculty and students

Name: Idaho National Laboratory (Geothermal Energy)
Date: January
Location: Online
Attendees: Gabriel Ilevbare, Trevor Atkinson, Travis McLing, John Koudelka, Rajiv Khadka, Stacey Whitmore, Mahesh Acharya (INL), Mustafa Mashal, Tadesse Wakjira, Jared Cantrell, Martin Blair (ISU)
Results/Impact: Geothermal Energy, SUPER Agreement discussions

Name: Idaho National Laboratory (Reactor Analysis and Design)
Date: February 2025
Location: Pocatello, ID
Attendees: Youssef Ballout, Chandu Bolisetti, Allison Ray (INL), Luke Voss (NRIC), Mustafa Mashal, Tadesse Wakjira, Jared Cantrell, Martin Blair (ISU)
Results/Impact: Development and deployment of advanced nuclear reactors

Name: Idaho National Laboratory (Reactor Analysis and Design)
Date: March 2025
Location: Online
Attendees: Vivek Agarwal (INL), Mustafa Mashal, Jared Cantrell, Martin Blair (ISU)
Results/Impact: Development and deployment of advanced nuclear reactors, workforce development opportunities, SUPER Agreement discussions

Section 11. Research Highlights

Updated 2/29/24 SK

Description: ISU 2024-2025 Distinguished Researcher & Outstanding Researcher
Date: April 2025
Impact: Dr. Mustafa Mashal, CAES Associate Director for ISU and Professor in the Department of Civil and Environmental Engineering, was selected as one of the five Outstanding Researchers and the 2024-2025 Distinguished Researcher at Idaho State University. Every year the Research Council selects five Outstanding Researchers based on six criteria: 1) significance/impact of the research, scholarship, creative activities in relation to the frontiers of knowledge in that field; 2) publication of research findings in peer reviewed national or international journals or juried/invitational shows, exhibits, or performances; 3) excellence in basic or applied research as evidenced by invention disclosures, provisional patent applications, perfected patents, advisory positions in industry, or mentorship of successful students; 4) evidence of extended, intentional development of the topic of research that resulted in a significant contribution; 5) any other evidence of the outstanding nature of the research activity that may be relevant. The review committees consider the entire body of research conducted over a career, but the work conducted at ISU would be emphasized in the review. The Research Council chooses one of the five Outstanding Researchers as the "Distinguished Researcher" who will be invited to occupy a seat on the Research Council for the 2025-2026 term. Dr. Mustafa Mashal was selected for this honor for the academic year 2024-2025.

More Information: https://www.isu.edu/academicaffairs/faculty-affairs/faculty-awards/staffdirectoryentries/dr-mustafa-mashal.html

Description: Idaho State University Signs New MOU with Universidad de Ingeniería y Tecnología in Peru
Date: May 8, 2025
Impact: Idaho State University is expanding its global research footprint through an agreement with an institution in Peru, building upon prior collaborations to spark new research opportunities.

Recently, representatives from Idaho State University signed a five-year Memorandum of Understanding with Universidad de Ingeniería y Tecnología (UTEC), in Lima, Peru. Over the next five years, ISU and UTEC plan to advance research initiatives, including submission of joint proposals, faculty and student exchanges, joint research symposiums, co-supervision of undergraduate and graduate students, and more.

"UTEC is a renowned university in applied research and engineering," said Mustafa Mashal, professor of civil engineering and special advisor in the office for research at ISU. "We look forward to continued collaboration with our colleagues and students of both institutions on pressing topics that are relevant to both Idaho and Peru, ranging from infrastructure resilience and affordable housing to environmental security to artificial intelligence and machine learning."

"This agreement seeks to foster scientific research collaboration and academic exchange to tackle global challenges for more resilient and sustainable civil infrastructure," said Dr. Luis Bedriñana, associate professor of civil engineering at UTEC. "For instance, the expertise of ISU's researchers and faculty can definitely help our students and professional partners at UTEC to provide better solutions for the earthquake engineering challenges we face in this part of the world. Moreover, this agreement can consolidate new forms of cooperation between Peru and the United States."

ISU and UTEC researchers have been collaborating on topics related to civil engineering since 2022, and several ISU graduate students have had the opportunity to work under the co-supervision of UTEC faculty and publish their research findings.

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ISU previously signed several international MoUs with universities in 2024, including Australian University (AU) in Kuwait and the University of Doha for Science and Technology (UDST) located in Qatar, and Gachon University in South Korea.

Link: https://www.isu.edu/news/2025-spring/idaho-state-university-signs-new-mou-with-universidad-de-ingenieria-y-tecnologia-in-peru.html

Section 12. Other

INL Joint Appointments:

1. Daniel LaBrier (Incoming)
2. Amir Ali (Incoming)
3. Jared Cantrell (Incoming)

Updates on ISU – INL SUPER Agreement:

The Strategic Understanding for Premier Education and Research, or SUPER agreement, is an agreement signed between the Idaho National Laboratory and Idaho State University. With this agreement, both facilities hope to deepen collaborative research and energy initiatives for the future. The SUPER agreement promotes strategies towards greater cooperation between both organizations, visiting research scholars, and joint symposia, seminars, workshops, and conferences. Longstanding research and development efforts in areas such as nuclear energy, high-performance computing and cybersecurity will also continue under this enhanced partnership.

Focus Area 1: Critical & Strategic Materials and Minerals

- Rock Characterization for Mineral Exploration (Large-scale Testing to
- Microscopy)
- Separation Chemistry
- Critical Minerals with a focus on Idaho's Resources (Upstream, Midstream, and
- Downstream)
- Digitalization, Machine Learning, Artificial Intelligence*

Focus Area 2: Energy-Environmental Security

- Development and Deployment of Advanced Nuclear Reactors
- Application of Water Resources for Energy Security
- Geothermal Energy
- Energy Storage Technologies
- Digitalization, Machine Learning, Artificial Intelligence*

*Cross-cutting subtopic for two focus areas

More info: https://www.isu.edu/research/industry/super-agreement/

Updated 2/29/24 SK

Proposal(s) Submitted/Awarded during Reporting Period

Principal Investigator	Proposal Title	Sponsoring Agency / Lead Institution	Submission Date	Start Date	End Date	Amount	Status
Rajib Mahamud	Tuning Voltage-Current Characteristics for Nonequilibrium Plasmas: A Unified Framework for Instabilities, Self-Organization, and Suppression Strategies	US Department of Energy	4/30/2025	2/1/2026	1/31/2031	$874,997	PS
Mackenzie Gorham	Nuclear Education Western Consortium (NEWC) - Democratizing Educational Opportunities among Underrepresented Communities in the Western United States	University of New Mexico	1/10/2025	6/1/2025	5/31/2030	$684,459	PS
Andrew Holland	American Chemical Society Project SEED High School Research Internships, 2025	American Chemical Society	2/6/2025	12/19/2024	2/6/2025	$14,000	PS
Tadesse Wakjira	HoT-GExAI: Hands-On Training in Generative and Explainable AI for Trustworthy Energy-Water Systems Modeling	Univ of Idaho	1/15/2025	7/1/2025	11/30/2025	$79,184	PS
Mostafa Fouda	AI-Driven State Estimation for Resilient Power and Water System	National Science Foundation	1/16/2025	8/1/2025	7/31/2027	$113,477	PS
Chad Pope	Development of a Large-Scale Reconfigurable Microreactor Test Bed User Facility	Battelle Energy Alliance LLC	2/26/2025	10/1/2025	9/30/2029	$6,000,000	PS
Kavita Sharma	UI CURE - Using Metabolomic Profiling to Study Healthy Aging: Teaching undergraduates to use the LC-MS/MS	Univ of Idaho	1/17/2025	5/1/2025	4/30/2026	$58,213	PS
Bruce Savage	I-CREWS - Increasing Water Storage Resilience and Energy Production in Aquifers via Subsurface Dams	Univ of Idaho	1/30/2025	8/1/2025	7/31/2027	$226,928	PS
Mary Lou Dunzik-Gougar	Evaluate and Benchmark Critical Configurations of the AGN-201m Reactor at ISU	Oak Ridge National Laboratory	2/3/2025	3/24/2025	9/30/2026	$1,010,356	AA
Minhaz Zibran	Idaho NASA EPSCoR Summer Faculty Fellowship	Univ of Idaho	1/24/2025	5/15/2025	7/31/2025	$7,200	PS
Farjana Eishita	Idaho NASA EPSCoR Summer Faculty Fellowship	Univ of Idaho	1/24/2025	5/19/2025	7/31/2025	$7,200	PS
Chad Pope	Engineering Support for the Development of a Digital Documented Safety Analysis Report	Battelle Energy Alliance LLC	2/25/2025	3/10/2025	8/30/2025	$93,519	AA
Srinath Pashikanti	Development of Novel Sphingolipid-Based Nanoemulsion for Targeted Psoriasis Therapy	Univ of Idaho	2/10/2025	5/1/2025	4/30/2027	$28,800	PS

Updated 2/29/24 SK

Amir Ali	Advanced Compact Heat Exchanger Technology for Efficient Energy Utilization	Idaho State Board of Education	2/26/2025	7/1/2025	6/30/2026	$125,000	AA
Rajib Mahamud	Collaborative Research: Beginning: Next-generation Engineering Experiential Traineeship for the SEMICONDUCTOR Workforce (NEXT-SEMICONDUCTORS)	National Science Foundation	2/27/2025	8/1/2025	7/31/2028	$500,000	PS
Mackenzie Gorham	Nuclear Safety Culture Case Study - multiple cascading events managements at the Fukushima Daiichi Power Plant in March 2011	Univ of Idaho	3/4/2025	6/1/2025	5/31/2026	$24,999	PS
Tadesee Wakjira	HERC-IGEM A Sustainable AI-Powered Low-Carbon Emission Concrete (SCALE Concrete): Leveraging Agricultural Byproducts and Wastewater for Circular Economy Solutions	Idaho State Board of Education	2/28/2025	7/1/2025	6/30/2028	$547,011	AA
Farjana Eishita	Facilitate and Monitor the Visualization and Modeling Research and Implementation	Battelle Energy Alliance LLC	4/9/2025	4/3/2025	9/30/2025	$90,000	AA
Donna Delparte	Leveraging Plant Chemistry to Conserve Threatened Vertebrate Herbivores and Support Nature-Based Economie	Boise State Univ	3/11/2025	11/1/2025	10/31/2029	$270,308	PS
Daniel LaBrier	Nuclear Science and Engineering Consortium for Nonproliferation (NSECNP)	Purdue University	3/27/2025	7/1/2026	6/30/2031	$871,718	PS
Donna Delparte	Applying Artificial Intelligence to Detect Potato Plants Infected with Potato Virus Y	Idaho State Dept of Agriculture	3/11/2025	11/1/2025	6/30/2028	$234,233	PS
Mostafa Fouda	AI/ML Applications in Uranium In-Situ Recovery (ISR) Mining	Battelle Energy Alliance LLC	4/3/2025	4/1/2025	9/30/2025	$50,741	PS

* PS = Pending, AA = Awarded, D = Denied