CAES Associate Director Tri-Annual Report

September – December 2024

Executive Summary

On December 4th, 2024 Idaho State University (ISU) and Idaho National Laboratory (INL) signed a Strategic Understanding for Premier Education and Research (SUPER) Agreement. ISU-INL have identified Critical and Strategic Materials and Minerals (CSMM), and Environmental Sustainability and Security (ESS) as the two focus areas for their collaboration.

ISU has increased its collaboration with INL on many fronts, including Joint Appointments (Incoming and Outgoing). More than 14 Joint Appointments (approved or pending approval) were initiated in 2024. ISU has more Joint Appointments than any other university with INL. All new Joint Appointments cover the areas outlined in the ISU-INL SUPER Agreement.

Between September 1st – December 31st 2024, ISU researchers had 27 peer-reviewed articles published, five accepted for publication, and 19 submitted (total of 51 publication). ISU CAES researchers presented collaborative research in 14 regional, national, and international conferences. Furthermore, the researchers submitted more than 20 proposals with a total amount of approximately $15.8M and received more than $170,000.

Six ISU researchers (Tadesse Wakjira, Kunal Mondal, Sarah Godsey, Kavita Sharma, Mostafa Fouda, John Kalivas) were named among the top 2% scientists globally by Stanford University "Authors Single Year Category" in 2024.

ISU formed new collaboration with industry such as Ash Gove Cement, Simplot, and Blue Planet Systems led by the ISU CAES Associate Director (Dr. Mustafa Mashal). There were visits from ISU and INL to the aforementioned companies. 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, carbon sequestration, structural health monitoring, cementitious materials, and other areas.

ISU CAES researchers (Tadesse Wakjira, Mostafa Fouda, Jared Cantrell) secured funding through the NSF I-CREWS and successfully deployed the "Hands-On Training in Applied AI and Machine Learning (HoT-AiML)" in the CAES Building. The training was conducted in a hybrid format and included two months of intensive training. In person graduation ceremonies were held in the CAES Building in Idaho Falls, ISU Pocatello campus, and Boise State University campus. This initiative was the first of its kind in the state of Idaho and trained over 220 participants from institutions across the region, including faculty, researchers, students, and staff. A significant number of INL employees (>70) at all levels participated in the training. More info can be found here.

 # Tours Led by University Reps: ≈ 10

#People Attended: ≈ 20-30

Section 1. University Publications on behalf of CAES

List publications and indicate pending, submitted/accepted.

Title: Optimizing Automotive MIMO Radar Detection with Regression Modeling-Based Correlation Test
Journal: IEEE Access, vol. 12, pp. 171728–171742, Nov. 2024
Authors: Hager S. Fouda, Heba S. Dawood, Mostafa M. Fouda, and Samar I. Farghaly
Status: Published, DOI: 10.1109/ACCESS.2024.3501075

Title: Using Deep Learning for Rapid Earthquake Parameter Estimation in Single-Station Single-Component Earthquake Early Warning System
Journal: IEEE Transactions on Geoscience and Remote Sensing, vol. 62, article no. 5934510, Nov. 2024
Authors: Mohamed S. Abdalzaher, M. Sami Soliman, and Mostafa M. Fouda
Status: Published, DOI: 10.1109/TGRS.2024.3492023

Title: Communication-Efficient and Privacy-Preserving Federated Learning via Joint Knowledge Distillation and Differential Privacy in Bandwidth-Constrained Networks
Journal: IEEE Transactions on Vehicular Technology, vol. 73, no. 11, pp. 17586–17601, Nov. 2024
Authors: Gad Gad, Eyad Gad, Zubair Md Fadlullah, Mostafa M. Fouda, and Nei Kato
Status: Published, DOI: 10.1109/TVT.2024.3423718

Title: Three Novel Statistical Tests-Inspired Spectrum Sensing Techniques for Cognitive Radio
Journal: IEEE Open Journal of the Communications Society, vol. 5, pp. 7041–7056, Oct. 2024
Authors: Hager S. Fouda and Mostafa M. Fouda
Status: Published, DOI: 10.1109/OJCOMS.2024.3487825

Title: A Lightweight Privacy-Preserving Load Forecasting and Monitoring Scheme Supporting Dynamic Billing for Smart Grids: No KDC Required
Journal: IEEE Internet of Things Journal, vol. 11, no. 19, pp. 32160–32171, Oct. 2024
Authors: Mohamed I. Ibrahem and Mostafa M. Fouda
Status: Published, DOI: 10.1109/JIOT.2024.3426486

Title: OTFS-Based Proactive Dynamic UAV Positioning for High-Speed Train Coverage
Journal: IEEE Open Journal of the Communications Society, vol. 5, pp. 5718–5734, Sept. 2024
Authors: Ehab Mahmoud Mohamed and Mostafa M. Fouda
Status: Published, DOI: 10.1109/OJCOMS.2024.3453906

Title: Enhancing Earthquakes and Quarry Blasts Discrimination Using Machine Learning based on Three Seismic Parameters
Journal: Elsevier Ain Shams Engineering Journal, Vol. 15, no. 9, article no. 102925, Sept. 2024
Authors: Mohamed S. Abdalzaher, Moez Krichen, and Mostafa M. Fouda
Status: Published, DOI: 10.1016/j.asej.2024.102925

Title: Communication-aided Terahertz Sensing: A Novel Indoor People Counting System Via Deep Learning
Conference presentations: Proc. of the 2023 IEEE Virtual Conference on Communications (IEEE VCC 2024), Virtual Conference, Dec. 3–5, 2024
Authors: Eslam Hasan, Elmahedi Mahalal, Muhammad Ismail, Zi-Yang Wu, Mostafa M. Fouda, and Zubair Md Fadlullah
Status: Published

Title: Altering 5G Network Parameters using Deep Reinforcement Learning to Optimize QoS and Security

Updated 2/29/24 SK

Conference presentations: Proc. of the 2023 IEEE Virtual Conference on Communications (IEEE VCC 2024), Virtual Conference, Dec. 3–5, 2024
Authors: Hamza Kaddour, Israel G. Olaveson, Cameron J. Krome, and Mostafa M. Fouda
Status: Published

Title: Adaptive Game Design Using Machine Learning Techniques: A Survey
Conference presentations: Proc. of the 2024 IEEE International Conference on Internet of Things and Intelligence Systems (IEEE IoTaIS 2024), Bali, Indonesia, Nov. 28–30, 2024
Authors: Md Mosharaf Hossan, Mostafa M. Fouda, and Farjana Z. Eishita
Status: Published

Title: AI-Driven Error Correction for KNN-Based RFID Localization
Conference presentations: Proc. of the 2024 IEEE International Conference on Internet of Things and Intelligence Systems (IEEE IoTaIS 2024), Bali, Indonesia, Nov. 28–30, 2024
Authors: Barrett Durtschi, Mostafa M. Fouda, and Andrew Chrysler
Status: Published

Title: GAN-Assisted Secret Key Generation Against Eavesdropping In Dynamic Indoor LiFi Networks
Conference presentations: Proc. of the 2024 IEEE 100th Vehicular Technology Conference (IEEE VTC 2024-Fall), Washington DC, USA, Oct. 7–10, 2024
Authors: Elmahedi Mahalal, Muhammad Ismail, Zi-Yang Wu, Mostafa M. Fouda, and Zubair Md Fadlullah
Status: Published

Title: Occupancy-level-aware Indoor Terahertz Channel Prediction: A Robust Deep Learning Approach
Conference presentations: Proc. of the 2024 IEEE 100th Vehicular Technology Conference (IEEE VTC 2024-Fall), Washington DC, USA, Oct. 7–10, 2024
Authors: Eslam Hasan, Elmahedi Mahalal, Muhammad Ismail, Zi-Yang Wu, Mostafa M. Fouda, and Nei Kato
Status: Published

Title: Unraveling Model Inversion Attacks: A Survey of Machine Learning Vulnerabilities
Conference presentations: Proc. of the 2024 IEEE International Conference on Artificial Intelligence, Blockchain, and Internet of Things (AIBThings), Mt. Pleasant, MI, USA, Sept. 7–8, 2024
Authors: Tanzim Mostafa, Mohamed I. Ibrahem, and Mostafa M. Fouda
Status: Published

Title: A Survey on the Landscape of Machine Learning Solutions for Detecting Phishing Attacks
Conference presentations: Proc. of the 2024 IEEE International Conference on Artificial Intelligence, Blockchain, and Internet of Things (AIBThings), Mt. Pleasant, MI, USA, Sept. 7–8, 2024
Authors: Shijon Das, Mohamed I. Ibrahem, and Mostafa M. Fouda
Status: Published

Title: Deep Enough? On the Effectiveness of Deep Learning in Phishing Email Detection

Conference presentations: Proc. of the 2024 IEEE International Conference on Artificial Intelligence, Blockchain, and Internet of Things (AIBThings), Mt. Pleasant, MI, USA, Sept. 7–8, 2024
Authors: Arifa I. Champa, Md Fazle Rabbi, Mostafa M. Fouda, and Minhaz F. Zibran
Status: Published

Title: Drone Detection: Countering Optical Evasion Strategies Using Deep Learning
Conference presentations: Proc. of the 2024 IEEE International Conference on Artificial Intelligence, Blockchain, and Internet of Things (AIBThings), Mt. Pleasant, MI, USA, Sept. 7–8, 2024
Authors: Shaibal Das and Mostafa M. Fouda
Status: Published

Title: Demand Response in Smart Grids: Challenges, Solutions, and Security Implications
Conference presentations: Proc. of the 2024 IEEE International Conference on Artificial Intelligence, Blockchain, and Internet of Things (AIBThings), Mt. Pleasant, MI, USA, Sept. 7–8, 2024
Authors: Hussien AbdelRaouf, Mostafa M. Fouda, and Mohamed I. Ibrahem
Status: Published

Title: Privacy Preservation Techniques in Smart Grids: Balancing Security and Utility in IoT-Driven Environments
Conference presentations: Proc. of the 2024 IEEE International Conference on Artificial Intelligence, Blockchain, and Internet of Things (AIBThings), Mt. Pleasant, MI, USA, Sept. 7–8, 2024
Authors: Hussien AbdelRaouf, Mostafa M. Fouda, and Mohamed I. Ibrahem
Status: Published

Title: Automated Phenotyping of Herbaceous Biomass Using U-NET Architecture for μ-CT Images Segmentation
Conference presentations: Proc. of the 2024 IEEE International Conference on Artificial Intelligence, Blockchain, and Internet of Things (AIBThings), Mt. Pleasant, MI, USA, Sept. 7–8, 2024
Authors: Antora Dev, Yomna Mohamed, Ahmed Hamed, Yidong Xia, Robert Seifert, and Mostafa M. Fouda
Status: Published

Title: A Lightweight AI Model for Anomaly Detection in Wireless Networks
Conference presentations: Proc. of the 2024 IEEE International Conference on Artificial Intelligence, Blockchain, and Internet of Things (AIBThings), Mt. Pleasant, MI, USA, Sept. 7–8, 2024
Authors: Thomas J. Kopcho Jr., Mostafa M. Fouda, and Cameron J. Krome
Status: Published

Title: Analyzing the Impact of Security Measures on Wi-Fi Quality of Service
Conference presentations: Proc. of the 2024 IEEE International Conference on Artificial Intelligence, Blockchain, and Internet of Things (AIBThings), Mt. Pleasant, MI, USA, Sept. 7–8, 2024
Authors: Thomas J. Kopcho Jr., Mostafa M. Fouda, Cameron J. Krome, Anna T. Quach, and Israel G. Olaveson
Status: Published

Updated 2/29/24 SK

Title: Enhanced IoT Data Security with Robust AES-CBC Encryption Algorithm Conference presentations: Proc. of the 2024 IEEE International Conference on Artificial Intelligence, Blockchain, and Internet of Things (AIBThings), Mt. Pleasant, MI, USA, Sept. 7–8, 2024
Authors: Mohamed A. Torad, Mohamed Abdulhamid ElKassas, Ahmed F. Ashour, Mostafa M. Fouda, and Eslam Samy El-Mokadem
Status: Published

Title: Claim vs. Capability: A Comparative Analysis of the SBOM Generation Tools for Rust Projects
Journal/conference presentations: 40th ACM/SIGAPP Symposium on Applied Computing Authors: M. Rabbi, A. Champa, and M. Zibran
Status: Accepted

Title: Password Security in Practice: An Appraisal Using Users' Perception and Machine Learning
Journal/conference presentations: 22nd Springer International Conference on Information Technology New Generations
Authors: Z. Beck, A. Crooks, M. Rabbi, M. Zibran, and F. Eishita
Status: Accepted

Title: Privacy for LLMs and LMMs Across Key Sectors: A Literature Survey
Journal/conference presentations: 22nd Springer International Conference on Information Technology New Generations
Authors: C. Nachuma, M. Fouda, and M. Zibran
Status: Accepted

Title: Dealing with Dependency: How Dependencies Shape Release Frequency in the Maven Ecosystem
Journal/conference presentations: 8th International Conference on Software and System Engineering
Authors: A. Svancara, G. Gardener, P. Gilbreath, C. Appiagyei, E. Barlow, and M. Zibran
Status: Accepted

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: Submitted

Title: An Analysis of Bangladeshi University Admission Applicants Using ML and XAI
Journal/conference presentations:
Journal of Research on Educational Effectiveness
Authors: A. Efat, S. Hasan, and M. Zibran
Status: Submitted

Updated 2/29/24 SK

Title: A Novel Ensemble Approach for Crop Disease Detection by Leveraging Customized EfficientNets and Interpretability
Journal/conference presentations: Elsevier Pattern Recognition Letters
Authors: N. Jannat, 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: Submitted

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: Submitted

Title: An Empirical Study on the Evolution and Maintenance of the Maven Central Dependency Graph
Journal/conference presentations: 22nd IEEE International Conference on Mining Software Repositories
Authors: N. Bhattarai, R. Stratton, and M. Zibran
Status: Submitted

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: Submitted

Title: The Popularity Paradox: Insights into Vulnerabilities and Updates in Maven Ecosystem
Journal/conference presentations: 22nd IEEE International Conference on Mining Software Repositories
Authors: M. Bhuiyan, M. Rabbi, S. Hasan, and M. Zibran
Status: Submitted

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: Submitted

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: Submitted

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: Submitted

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: Submitted

Title: Microbial Fuel Cells – Demonstrating the fundamental of enzymatic and microbial fuel cells and their latest advancement and challenges
Journal/conference presentations: Book Chapter
Authors: Kolajo, Samjhana Pradhan, Chikashi Sato, and Kavita Sharma
Status: Submitted

Title: Synthesis and Biological Evaluation of Desacetylmatricarin Derivatives Isolated from Basin Big Sagebrush
Journal/conference presentations: Separations 2024, 11(7), 217; https://doi.org/10.3390/separations11070217
Authors: N. Evelin Paucar, Samjhana Pradhan, Karl De Jesus, Sameena Mateen, Srinath Pashikanti, Kavita Sharma
Status: Published

Title: Sesquiterpene lactones and flavonoid from the leaves of basin big sagebrush (artemisia tridentata subsp. tridentata): isolation, characterization and biological activities.
Journal/conference presentations: Molecules 2024, 29(4), 802; https://doi.org/10.3390/molecules29040802
Authors: Rosemary Anibogwu, Karl De Jesus, Samjhana Pradhan, Shanae Van Leuven, Kavita Sharma
Status: Published

Title: Are Rock Glaciers Water Sources or Water Processors in Alpine Streams? Hydrologic Insights from Dickey Peak Rock Glacier Stream, Central Idaho, USA
Journal/conference presentations: Journal of Permafrost and Periglacial Processes (Wiley)
Authors: OL Stanley and GD Thackray

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Status: Submitted

Title: Are rock glaciers water sources or water processors in alpine stream systems?
Journal/conference presentations: Geological Society of America Abstracts with Programs. Vol. 56, No. 5, 2024; doi: 10.1130/abs/2024AM-401525
Authors: GD Thackray and OL Stanley
Status: Published

Title: Rock glaciers and alpine stream resilience in the semi-arid northern Rocky Mountains; Geological Society of America Abstracts with Programs. Vol. 56, No. 5, 2024, doi: 10.1130/abs/2024AM-401520
Authors: OL Stanley and GD Thackray
Status: Published

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

Title: Sustainable Concrete with Dairy Wastewater: A State-of-the-Art Review
Journal/conference presentations: Conference, IABSE Symposium Tokyo 2025
Authors: Samjhana Rajbhandari, Kavita Sharma, Tadesse Gemeda Wakjira, and Mustafa Mashal
Status: Accepted

Title: Use of Dairy Wastewater in Concrete: A State-of-the-Art Review
Journal/conference presentations: Conference, ASCE India Section Northern Region
Authors: Samjhana Rajbhandari, Kavita Sharma, Tadesse Gemeda Wakjira, and Mustafa Mashal
Status: Submitted

Title: Stress-Strain Behavior of Confined Green Concrete
Journal/conference presentations: Conference, IABSE Symposium 2025
Authors: Pawan Bhattarai, Tadesse Gemeda Wakjira, Jared Cantrell, Mustafa Mashal
Status: Submitted

Title: Study on Confinement of Ultra-High Performance Concrete Using Ties
Journal/conference presentations: Conference, IABSE Symposium 2025
Authors: Manish Acharya, Tadesse G. Wakjira, Mustafa Mashal
Status: Submitted

Title: Application of +/-45 Degree Bidirectional FRP to Improve Shear Transfer Capacity Across RC Slab-to-Wall Connections
Journal/conference presentations: Conference, FIB Symposium 2024
Authors: Aashish Deo, Tadesse G. Wakjira, Jared Cantrell, Scott Arnold, Mustafa Mashal
Status: Accepted

Updated 2/29/24 SK

Title: Retrofit of Slab-To-Wall Connections to Improve Shear Transfer Across Cold Joints Using Externally Bonded FRP
Journal/conference presentations: Conference, CICE conference-25
Authors: Aashish Deo, Tadesse G. Wakjira, Mustafa Mashal, Scott Arnold
Status: Submitted

Title: Cyclic Loading Performance of U-Shaped Flexural Plates: A Comparative Analysis of Conventional and Additive Manufacturing Methods using 316L Stainless Steel
Journal/conference presentations: Conference, IABSE Congress Ghent 2025
Authors: Aashish Deo, Tadesse G. Wakjira, Mustafa Mashal, Scott Arnold
Status: Only Abstract

Title: Comparative Analysis of Confined and Unconfined UHPC Column under Axial Loading
Journal/conference presentations: Conference, NZSEE Conference 2025
Authors: Manish Acharya, Tadesse G. Wakjira, Mustafa Mashal
Status: Only Abstract

Title: Seismic Response of High-Strength Steel Reinforced Ultra-High Performance Concrete (UHPC) Columns Using Factorial Design of Experiment
Journal/conference presentations: Conference, BEI Conference 2025
Authors: Raghav Sharma Poudel, Tadesse G. Wakjira, Mustafa Mashal
Status: Only Abstract

Title: Concept and Experimental Validation of Using Titanium Alloy Bars (TiABs) as Flexural Reinforcing in Concrete Beams
Journal/conference presentations: Journal, Structural Engineering International
Authors: Aashish Thapa, Mahesh Acharya, Mustafa Mashal
Status: Published

Section 2. Conferences Attended on behalf of CAES

Name: 2024 IEEE 100th Vehicular Technology Conference (IEEE VTC 2024-Fall)
Location: Washington DC, USA, Oct. 7–10, 2024
Purpose: Presenting accepted papers
Attendees from university/CAES: Mostafa Fouda

Name: 2024 IEEE 100th Vehicular Technology Conference (IEEE VTC 2024-Fall)
Location: Washington DC, USA, Oct. 7–10, 2024
Purpose: Presenting accepted papers
Attendees from university/CAES: Mostafa Fouda

Name: II Weeks in Applied Science and Technology, Altamira Unit of the IPN-CICATA in Tamaulipas State, Mexico, October 7 - 11, 2024.

Updated 2/29/24 SK

Location: Altamira, Mexico
Purpose: Plenary Speaker, Title “Microbial Fuel Cell with Ceramic Membrane Separator for Nutrient Recovery from Potato-Process Wastewater”
Attendees from university/CAES: Chikashi Sato (ISU)

Name: 2024 9th Asia Conference on Environment and Sustainable Development (ACESD 2024), November 9-11, 2024.
Location: Osaka, Japan
Purpose: Keynote Speaker, Title “Integrating Microbial Fuel Cell with Hydroculture System for Nutrient Recovery from Wastewater”
Attendees from university/CAES: Chikashi Sato (ISU)

Title: Experimental and Data-Driven Evaluation of the Bond Strength between UHPC and Titanium Alloy Bars
Journal/conference presentations: Journal of The Institution of Structural Engineers (Structures)
Authors: Mahesh Acharya, Luis Alberto Bedriñana, and Mustafa Mashal
Status: Pending

Title: Numerical Investigation of the Bond-Slip Behavior between Ultra-High Performance Concrete and Titanium Alloy Bars
Journal/conference presentations: Conference Paper – fib symposium 2024
Authors: Heider Mendoza Portillo, Mahesh Acharya, Luis Alberto Bedriñana, and Mustafa Mashal
Status: Published

Title: Numerical Investigation of the Cyclic Behavior of UHPC Piers with Titanium Alloy Reinforcement Bars Based on Distributed Plasticity Model
Journal/conference presentations: Conference Paper – fib symposium 2024
Authors: Jorge Atusparia, Heider Mendoza Portillo, Mahesh Acharya, Luis Alberto Bedriñana, and Mustafa Mashal
Status: Published

Title: Concept and Experimental Validation of Using Titanium Alloy Bars (TiABs) as Flexural Reinforcing in Concrete Beams
Journal/conference presentations: Structural Engineering International
Authors: Aashish Thapa, Mahesh Acharya, and Mustafa Mashal
Status: Accepted

Name: Exploring the Potential of Electrogens in a Microbial Fuel Cell-Hydroponic System Through Multiomics Approach; Ghazaleh Alikaram, Samjhana Pradhan, Chikashi Sato, and Kavita Sharma
Location: NORM 2024 June 23–26, 2024 Washington State University Pullman, Washington Hosted by: ACS Washington-Idaho Border Section
Purpose: To showcase our work and establish collaborations within the regional community.
Attendees from university/CAES: Kavita Sharma

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Name: Geological Society of America, annual meeting
Location: Anaheim, California
Purpose: Present research findings from CAES-funded project. Chair technical session focused on mountain water resources, develop new collaborations
Attendees from university/CAES: Glenn Thackray, Olivia Stanley

Name: IABSE Symposium
Location: San Jose, Costa Rica, Sep. 25-27, 2024
Purpose: Presenting accepted papers and exploring international research collaboration
Attendees from university/CAES: Mustafa Mashal, Jared Cantrell

Name: Pacific Basin Nuclear Conference
Location: Idaho Falls, Idaho, Oct. 7-10, 2024
Purpose: Presenting accepted papers, networking with industry and collaborators from national laboratories, discussions and showcasing CAES and its capabilities
Attendees from university/CAES: Mustafa Mashal, Phil Reppert, John Russell, Sunny Katseanes

Name: Geothermal Rising Conference
Location: Waikoloa, Hawaii, Oct. 27-30, 2024
Purpose: Learning about opportunities in geothermal energy and building collaboration with INL, industry, and other partners
Attendees from university/CAES: Mustafa Mashal, Travis McLing, Trevor Atkinson, Rob Podgorney and others from INL

Name: fib Symposium
Location: Christchurch, New Zealand, Nov. 11-13, 2024
Purpose: Presenting international research on advanced materials and resilience of the built environment
Attendees from university/CAES: Mustafa Mashal

Sections 3. University Proposals Related to CAES Activities (see attached table at the end of the report)

Section 4. Patents, Licenses, other IP
List all patents, licenses, and/or other IP related to CAES: 0
What were the impactful accomplishments associated with CAES strategic initiatives?

Section 5. Grants and Awards

Minhaz Zibran

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

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

3. Title: Analyzing the Threats and Defense Tactics in Collaborative Mixed Reality (CMR) Virtual Environments
   Awarding Organization/Institution: ISU ISGP
   Timeframe (if applicable): Dec 2024 – June 2025
   Award Amount: $5,998

4. Title: Quality Assurance for Better Scientific Software Awarding Organization/Institution: DoE and NSF Timeframe (if applicable):
   Award Amount: BSSw Fellowship Honorable Mention, which includes travel support to the US- RSE (United States Research Software Engineer) conference in Philadelphia, PA in October 2025.

Rene Rodriguez

Title: Assessment of Potential Melt Wire Candidates for Nuclear Reactor Temperature Monitoring
Awarding Organization/Institution: BEA/DOE
Timeframe (if applicable): Oct. 2024 – June 2024
Award Amount: $20,280

Glenn Thackray

Title: Synthetic Aperture Radar Applications to Assess Rock Glacier Change and Alpine Water Cycle Impacts in the Western United States
Awarding Organization/Institution: NASA Epscor
Timeframe (if applicable): 7/1/24-10/31/25
Award Amount: $49,743

2025 ISU-CAES Internal Seed Grants (Continuing):
Total of seven projects were selected for funding ($103,575). Funding was awarded to projects associated with CAES Focus Areas and INL's Strategic Science and Technology (S&T) Initiatives and that engendered collaboration with INL researchers. Proposals were evaluated in a double-blind peer review process by scientists from the United States Department of Energy's national laboratories. The main factors considered in proposal evaluation were intellectual merit/quality, relation to CAES Focus Areas and INL's Strategic S&T Initiatives and potential for external funding.

1. Dr. Chikashi Sato, Professor, Department of Civil and Environmental Engineering

- "Lab Validation of Effectiveness of a Sustainable Solution in Mitigating Near-Shore Ocean Acidification"
- ISU Co-PIs: Dr. John Dudgeon, Dr. Kavita Sharma
- INL Collaborator: Dr. Asef Redwan
- $15,000

2. Dr. Dan Dale, Professor, Department of Physics
   - "Development of a Lab for Analysis of Geothermal Brines"
   - ISU Co-PI: Dr. Tony Forest
   - INL Collaborators: Dr. Edna Cardenas, Dr. Michael Reichenberger
   - $13,575

3. Dr. Joshua Pak, Professor, Department of Chemistry
   - "Study of Precursors for F-Element Nanomaterials"
   - ISU Co-PI: Dr. Andy Holland
   - INL Collaborators: Dr. Liyanage Ashini Jayasinghe, Dr. Christopher Zarzana
   - $15,000

4. Dr. Paul Bodily, Associate Professor, Department of Computer Science
   - "Crowdsourcing and Visualization of Advanced Computational Theory for Real-World Combinatorial Problems"
   - INL Collaborator: Dr. Rajiv Khadka
   - $15,000

5. Dr. Mahesh Acharya, Affiliate Faculty, Department of Civil and Environmental Engineering/ Postdoctoral Research Associate, Idaho National Laboratory
   - "Novel Materials for Geothermal Wells"
   - INL Collaborators: Trevor Atkinson and Dr. Travis McLing
   - ISU Co-PIs: Jared Cantrell, Dr. Daniel LaBrier, Dr. Mustafa Mashal
   - $15,000

6. Dr. Mostafa Fouda, Associate Professor, Department of Computer Science
   - "Advancing Critical Materials Exploration"
   - INL Collaborator: Ahmed Hamed
   - ISU Co-PIs: N/A
   - $15,000

7. Dr. Minhaz Zibran, Associate Professor, Department of Computer Science
   - "Interactive Software Visualization"
   - INL Collaborator: Kolton Heaps
   - ISU Co-PI: Farjana Eishita
   - $15,000

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Section 6. Incoming CAES Personnel
List any intern, undergrad student, grad student, postdoc, professor, fellow, employee or other visitor that is new to CAES.

Glenn Thackray

Name: Jack Mason (graduate student)
Institution: ISU
Focus of work: Linking hydrology and hydropower potential to rock glacier motion through interferometric synthetic aperture radar analysis

Mahesh Acharya & Mustafa Mashal

Name: Saugat Dotel (graduate student)
Institution: ISU
Focus of work: Structural testing of novel concrete mixes reinforced with titanium alloy bars and composite materials under various loading and conditions

Name: Anjan Koirala (graduate student)
Institution: ISU
Focus of work: A novel cement grout for geothermal well applications

Jared Cantrell & Mustafa Mashal

Name: Prajita Budhathoki (undergraduate student)
Institution: ISU
Focus of work: Energy and environment research

Jared Cantrell & Mustafa Mashal

Name: Tyler Johnson (undergraduate student)
Institution: ISU
Focus of work: Experimental work and data analysis

Section 7. Outgoing CAES Personnel
List any intern, undergrad student, grad student, postdoc, professor, fellow, employee or other visitor that is leaving CAES.

Glenn Thackray

Name: Olivia Stanley
Institution: ISU (now University of Colorado)
Focus of work: rock glacier distribution and alpine stream hydrology as applied to small hydropower potential

Section 8. Industry Engagement
List all new industries you've engaged.
Mustafa Mashal, Jared Cantrell, Mahesh Acharya

Name: Ash Grove Cement
Company Location: Kansas City
Project Focus: Reducing carbon footprint of cement and developing novel types of cement for specific energy-related applications

Mustafa Mashal, Jared Cantrell

Name: Blue Planet System
Company Location: Los Gatos, California
Project Focus: Carbon capture and mineralization for applications in concrete mixes

Name: Premier Technology
Company Location: Blackfoot, Idaho
Project Focus: Package performance demonstration for nuclear casks

Mustafa Mashal, Jared Cantrell, Rene Rodriguez, Sri Pashikanti, several INL researchers

Name: Simplot
Company Location: Pocatello, Idaho
Project Focus: Critical and strategic minerals

Section 9. New Equipment
List new research equipment associated with CAES.

Nothing to report.

Section 10. Collaborative Research Events
List all workshops, events, and planning meetings related to CAES activities:

Tadesse Wakjira, Mostafa Fouda, Jared Cantrell

Name: Hands-On Training in Applied Artificial Intelligence and Machine Learning (HoT-AML)
Date: 10/01/2024 to 11/21/2024
Location: CAES Auditorium
Attendees: Over 220 faculty, staff, and students
Results/Impact: Students, researchers, and faculty have been trained and empowered with emerging technologies and hands-on training in applied AI and machine learning to tackle critical real-world challenges.

Glenn Thackray

Name: The Cryosphere & Mountain Hydrology, Past and Present and Future (conference technical session)
Date: 9/22/24
Location: Anaheim, CA
Attendees: 40 scientists, various institutions
Results/Impact: New collaborations established, scientific finding exchanged, and planning for future collaborative events.

Mustafa Mashal, Jared Cantrell, Tadesse Wakjira, Mahesh Acharya

Name: Multiple meetings (>30) with INL researchers discussing opportunities for research collaboration in geothermal energy, machine learning, artificial intelligence, carbon sequestration, carbon reduction, concrete and other topics. Facilitation of new joint appointments between ISU and INL, ISU-INL SUPER Agreement and focus areas etc.
Date: 09/01-12/01, 2024
Location: Pocatello, Idaho Falls, and online
Attendees: various ISU and INL units
Results/Impact: Signing of ISU-INL SUPER Agreement, the two focus areas for collaboration were identified, >10 incoming and outgoing joint appointees between ISU and INL were approved, new collaborations established, scientific finding exchanged, and planning for future collaborative events and joint proposals.

Section 11. Research Highlights
List significant accomplishments (R&D milestones, etc.) related to CAES people, equipment, projects, and facilities.

Description: Top 2% Scientists Globally, Stanford University "Authors Single Year Category" (Link). "Now in its sixth iteration, this prestigious list identifies the world's leading researchers, representing approximately 2% of all scientists worldwide. It encompasses standardized data on citations, h-index, and a wide range of bibliometric indicators. Researchers are classified into 22 scientific fields and 174 sub-fields based on Science-Metrix's established classification, drawing from Scopus data provided by Elsevier through ICSR Lab." (Reference)
Date: 2024
Impact: Research excellence and global reputation and recognition of ISU researchers.

Description: NSF I-CREWS Hands-On Training in Applied AI and Machine Learning (HoT-AiML)
Date: September – December, 2024
Impact: Funded by NSF I-CREWS, this program was successfully concluded after two months of intensive training. This initiative was the first of its kind in the state of Idaho and engaged over 220 participants from institutions across the region, including faculty, researchers, students, and staff. A significant number of INL employees (>70) participated in the training. More info can be found here.

Section 12. Other

Important updates from your university that relate to CAES. This could include changes to joint appointments, student engagement, major events, staff changes, high-level visits/tours, stakeholder engagement, lab milestones, collaborative meetings, etc.) and which you want to include in the annual report but don't fit into one of the categories above.

INL, ISU sign SUPER agreement to broaden collaborative research initiatives

In December, Idaho National Laboratory (INL) and Idaho State University (ISU) signed an agreement to deepen collaborative research and development projects that will advance solutions to the nation's energy and security challenges.
The newly signed Strategic Understanding for Premier Education and Research, or SUPER agreement, expands cooperation between ISU students, faculty, and laboratory researchers in two key areas: critical and strategic materials and minerals, and environmental sustainability and security. Research in critical and strategic materials and minerals involves the study and development of essential materials and minerals that are vital for modern technology and industrial processes but are at risk of supply disruptions. Environmental sustainability efforts will focus on carbon reduction, sequestration and storage technologies, digitalization and artificial intelligence, geothermal energy, and spent fuel storage and disposition, among others.

"Since 1949, when our laboratory was first established as the National Reactor Testing Station, we have maintained a strong research relationship with Idaho State University," said INL Laboratory Director John Wagner. "Research in critical and strategic materials and minerals is essential to our nation's manufacturing and tech centers. This agreement with the university has the potential to elevate INL's impact on this urgent national priority."

The five-year agreement will promote greater cooperation between both organizations through shared academic materials, 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.

"ISU and INL have a long history of successful partnerships and collaborations," said ISU President Robert Wagner, "ISU has more joint appointments with INL than any other single university and we continue to grow in ways that give ISU faculty and students opportunities to work directly with INL. Not only do we prepare our students for the future, INL and ISU faculty are finding innovative solutions to the energy challenges ahead."

Learn more about INL's SUPER agreements with the universities at https://inl.gov/inl-initiatives/education/super/.

ISU experts offering free training in artificial intelligence and machine learning to the public

Idaho State University News release Sep 18, 2024

POCATELLO — Now's your chance to learn the latest and greatest when it comes to artificial intelligence and machine learning from a pair of experts at Idaho State University.

Starting Oct. 1, Mostafa Fouda, associate professor of electrical and computer engineering, and Tadesse Wakjira, adjunct faculty member in the civil and environmental engineering department, will host a free hands-on training in applied artificial intelligence and machine learning. Classes will be held every Tuesday and Thursday from noon to 1 p.m. from Oct. 1 to Nov. 21 in person at the Center for Advanced Energy Studies, 995 MK Simpson Boulevard in Idaho Falls, and via Zoom/Teams. The course is designed for university faculty, students, researchers, and industry professionals and will cover the fundamentals and practical applications of machine learning, developing robust and reliable models, implementing diverse AI/ML techniques and more.

"Nowadays, AI and machine learning are revolutionizing every sector by offering robust solutions to complex challenges, making these skills indispensable," said Fouda. "Students and researchers should attend this training because it provides a unique opportunity to gain practical skills and empower them to make a meaningful impact and stay competitive in their field."

"Participants will leave this training with a solid understanding of artificial intelligence and machine learning fundamentals, as well as knowledge they can apply to real-world problems," Wakjira said. "The training is designed to build confidence and provide hands-on experience so that participants not only gain knowledge but also develop the ability to apply AI/ML techniques to address relevant challenges."

If you have questions about the course, contact Mostafa Fouda at mfouda@isu.edu or Tadesse Wakjira at tadessewakjira@isu.edu.

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
Mustafa Mashal	Sustainable Modular Adaptive and Resilient Construction Technology (SMART) in the State of Qatar	QRDI - Qatar Research, Development and Innovation Council	9/30/2024	12/1/2024	11/30/2027	$144,784	D
Kavita Sharma	A Sustainable Concrete Incorporating Wastewater from Dairy Industry	Build Dairy	9/26/2024	1/1/2025	12/31/2027	$230,141	D
Jessy Sears	Building Native American and Rural Community Emergency Management Capabilities through Training.	US Department of Homeland Security	9/30/2024	9/1/2024	8/31/2027	$5,181,845	PS
Mackenzie Gorham	Scholarship for Nuclear Operations Technology Students	US Nuclear Regulatory Commission	9/6/2024	4/30/2025	4/29/2027	$140,390	D
Chad Pope	FY25 INL Joint Appointment Agreement - Chad Pope	Battelle Energy Alliance LLC	9/16/2024	10/1/2024	9/30/2025	$114,400	PS
Jerry Anhorn	Cybersecurity Consortium Idaho	US Department of Labor	10/16/2024	2/1/2025	1/31/2029	$5,567,570	D
Dan LaBrier	Development of an Introductory Hands-On Short Course for Nuclear Engineering Programs in the Intermountain Western U.S. using the Idaho State University AGN-201 Reactor	US Department of Energy	10/15/2024	8/1/2025	7/31/2027	$188,526	PS
Tadesse Wakjira	LEAP-HI: Innovative Habitats: Manufactured Homes to Combat Natural Disasters and Inequality	National Science Foundation	9/17/2024	7/1/2025	6/30/2030	$199,968	PS
Kavita Sharma	NIH SuRE First - Gut Microbiome Modulation for Alzheimer's Disease: A Study on Behavioral Endophenotypes and Inflammatory Responses	National Institutes of Health	9/26/2024	7/1/2025	6/30/2029	$696,655	PS
Mostafa Fouda	Collaborative Research: PDaSP: Track 1: PDaSAFL: Private Data Sharing	National Science Foundation	9/26/2024	6/1/2025	5/31/2027	$333,334	PS

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	Through Practical and Trustworthy Asynchronous Federated Learning						
Kristi Moser-Mcintire	FY25 CAES Deputy Associate Director & Safety Officer	Battelle Energy Alliance LLC	9/26/2024	10/1/2024	6/30/2025	$113,972	AA
Sri Pashikanti	NIH SuRE - Inducing Apoptosis in Castration-Resistant Prostate Cancer by Targeting Sphingomyelin Synthase 1 for mono and combination therapy	National Institutes of Health	9/27/2024	7/1/2025	6/30/2029	$553,194	PS
Kristi Moser-Mcintire	FY25 CAES Assistant Safety Officer - BSU	Boise State Univ	10/8/2024	10/1/2024	6/30/2025	$9,740	AA
Rajib Mahamud	Nonequilibrium Plasma Flame Interactions and Flame Propagation in Laser Induced Ignition	National Science Foundation	10/9/2024	6/16/2025	6/15/2027	$199,672	PS
Rene Rodriguez	Materials Development for In-pile Peak Temperature Monitoring	Battelle Energy Alliance LLC	11/1/2024	11/12/2024	6/30/2025	$20,513	AA
Kavita Sharma	NIH R15 - Investigating the Impact of GABA-producing Probiotics on Healthy Aging	National Institutes of Health	10/25/2024	7/1/2025	6/30/2028	$420,804	PS
Kristi Moser-Mcintire	FY25 Chemical Purchases to Support Projects at Microscopy and Characterization Suite (MaCS) Laboratory	Battelle Energy Alliance LLC	12/20/2024	12/3/2024	6/30/2025	$27,871	AA
Richard Schultz	Understanding the Effects of Bypass Flows on Normal Operation and PLOFC Conditions in Pebble Bed Reactors	Purdue University	11/13/2024	7/1/2025	6/30/2028	$98,875	PS
Rajib Mahamud	Collaborative Research: ECLIPSE: Study of Nonequilibrium Plasma Kinetics on the Growth and Thermal Performance of Nano Carbon Allotrope Heterostructures for Microelectronics	National Science Foundation	12/9/2024	6/1/2025	5/31/2028	$322,596	PS
Kavita Sharma	NSF MRI: Acquisition of a Liquid Chromatography - High Resolution Mass Spectrometry System for	National Science Foundation	11/15/2024	7/1/2025	6/30/2028	$1,011,970	PS

	Advancing Multidisciplinary Research and Educational Initiatives						
Donna Delparte	NSF: LEO in Action: Illuminating Lunar Science and Earth Communities to Broaden Inclusive, Informal STEM Learning	Univ of Louisiana at Lafayette	12/19/2024	7/1/2025	6/30/2030	$199,874	PS

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