First, a bit of my background…

- Colorado Native
- First Generation College Grad
- At home in the Mountains

COLORADOSCHOOLOFMINES
EARTH • ENERGY • ENVIRONMENT

Academic Background

- BS Physics, KU
- BS Engineering Physics, KU
  - Chemical Engineering
- PhD Geophysics, Rice
- Research Area
  - Wavefield Imaging
- Work at the boundaries
  - Hydrology, Glaciology, Archaeology, Hydrocarbon Exploration, Ecology, Geothermal, Environmental Engineering

Alaskan Arctic: Hydrology and Ecology

Bénin, West Africa: Groundwater modeling and management

DOE Hanford Site: Environmental Engineering

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Leadership Experience

- Led numerous research teams around the globe
- CGISS Director
- SEG NSGS President
- SEG President
- Mines Geophysics Department Head
- Mines Dean of Earth Resource and Environmental Programs
- Mines Vice President of Global Initiatives

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International Experience

- Ran research projects in
  - Norwegian Arctic, Scotland, Italy, China, West Africa
- Managed business operations in
  - Beijing and Dubai
- Negotiated and cultivated business partnerships in
  - Asia, Europe, Middle East, South America
- Worked with government and academic partners in
  - Asia, Middle East, Europe, South America
- Over 100 invited presentations, speeches, and shortcourses in more than 40 countries

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- Worked with government and academic partners in
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- Over 75 invited presentations, speeches, and shortcourses in more than 20 countries

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Program Structure & Schedule

1) Kickoff Session (In Person) - May 13, 2026

Exploration & Workforce Development Session (1 day, in-person)
A high-touch kickoff to align on program goals, connect the learning to workforce development needs, and launch the tailings-focused content with shared context and discussion.

Real-time translation (English → Spanish) services will be provided.

Facilitators

- John Bradford, Vice President, Global Initiatives and Business Development
- Heather Lammers, Associate Department Head & Teaching Assistant Professor (virtual)

2) Online Course Series (Self-Paced) - May to July 2026

Six short courses delivered online and released in sequence to build understanding step-by-step.

Translation Approach (English → Spanish)

- Google Translate will be used to translate course content.
- Mines ProEd will translate course images/visuals that cannot be translated using Google Translate.

Course Release Dates

- May 18, 2026: Course 1 – *Introduction to Tailings*
- June 1, 2026: Course 2 – *Tailings: Technology and Site Selection*
- June 15, 2026: Course 3 – *Closure and Reclamation for Tailings Projects*
- June 29, 2026: Course 4 – *Tailings Instrumentation and Monitoring*
- July 6, 2026: Course 5 – *Risk Assessment and Mitigation for Tailings Management*
- July 20, 2026: Course 6 – *Emergency Response and Preparedness for Tailings*

Instructor

- Heather Lammers, Associate Department Head & Teaching Assistant Professor

3) Wrap-Up Workshop (In Person) - August 12–19, 2026

2 days, in-person.
A capstone experience focused on pulling key concepts together, sharing insights, and translating learning into next steps for improved tailings practices.

Real-time translation (English → Spanish) services will be provided.

Instructor

- Heather Lammers, Associate Department Head & Teaching Assistant Professor

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Completion Recognition

Participants who complete the hybrid programming to Mines' satisfaction will receive a Mines Marker of Completion.

Colorado School of Mines: Leading the Future of Mining

Innovation, Sustainability, and Workforce Development

Mines' Core Strengths: A World Leader in Mining and Mineral Engineering

- **#1 Mineral and Mining Engineering Program Worldwide** (QS World University Rankings).
- Unique focus on solving critical scientific and engineering challenges related to Earth, Energy, and Environment.
- Interdisciplinary research and collaborative approach, driving positive societal impact.

Key Research Centers: Mining and Metals

Critical Materials Institute
AN ENERGY INNOVATION HUB

KIEM
Kroll Institute for Extractive Metallurgy

COLORADO SCHOOL OF MINES | Earth Mechanics Institute (EMI)

CR³ CENTER FOR RESOURCE RECOVERY AND RECYCLING

Key Research Centers: Mineral Exploration

CMRS
Center for Mineral Resources Science

CASERM
CENTER TO ADVANCE THE SCIENCE OF EXPLORATION TO RECLAMATION IN MINING

CWP
Center for Wave Phenomena

RCP
RESERVOIR CHARACTERIZATION PROJECT

Key Research Centers: Sustainability and Automation

Institute for Initiatives in Latin America

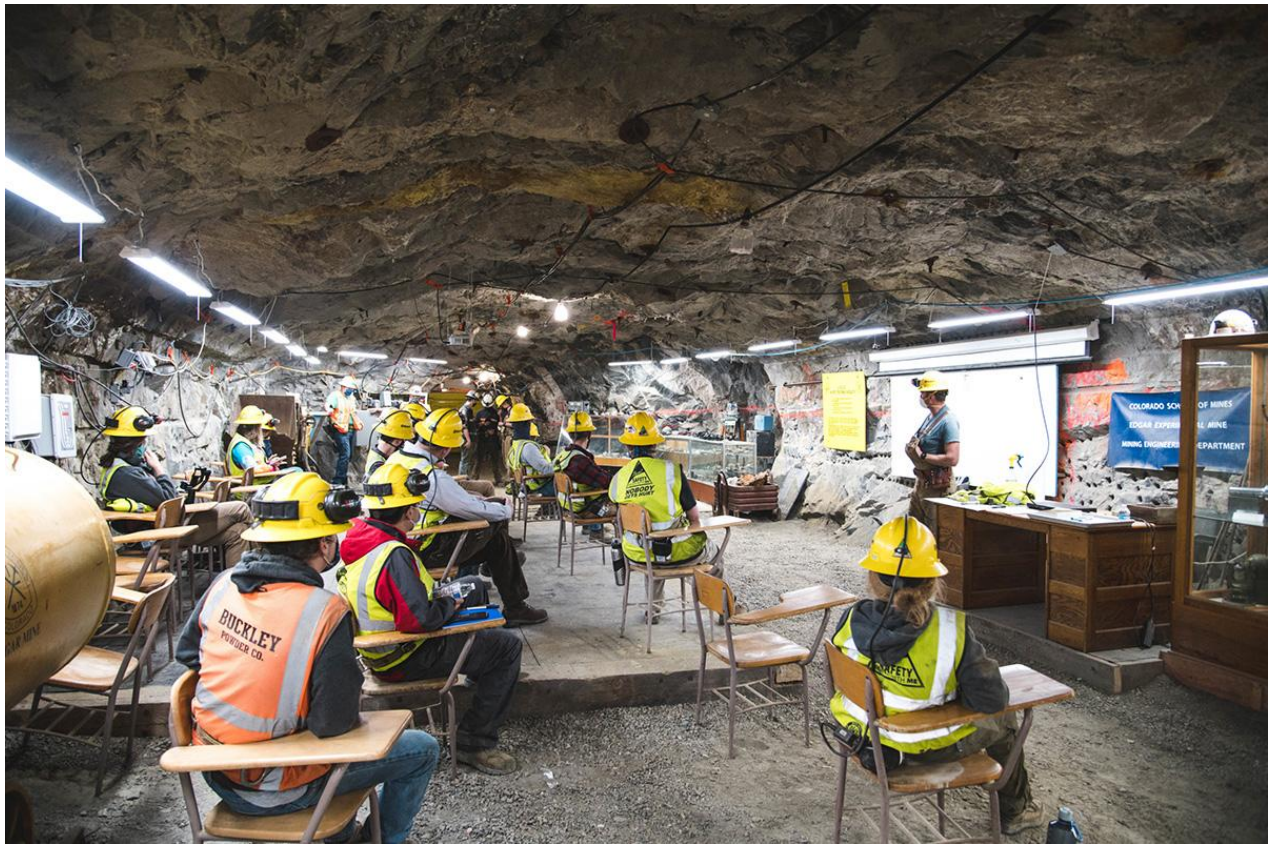
M³ROBOTICS

Medical • Magnetic • Mining

MINES CCUS INNOVATION CENTER

The Edgar Mine: Experiential Learning and Cutting-Edge Research

- An operational experimental mine for hands-on education and research in mining engineering and operations.
- Proving ground for new developments.
- Provides students with practical experience in mine surveying, rock mechanics, ventilation, and safety.



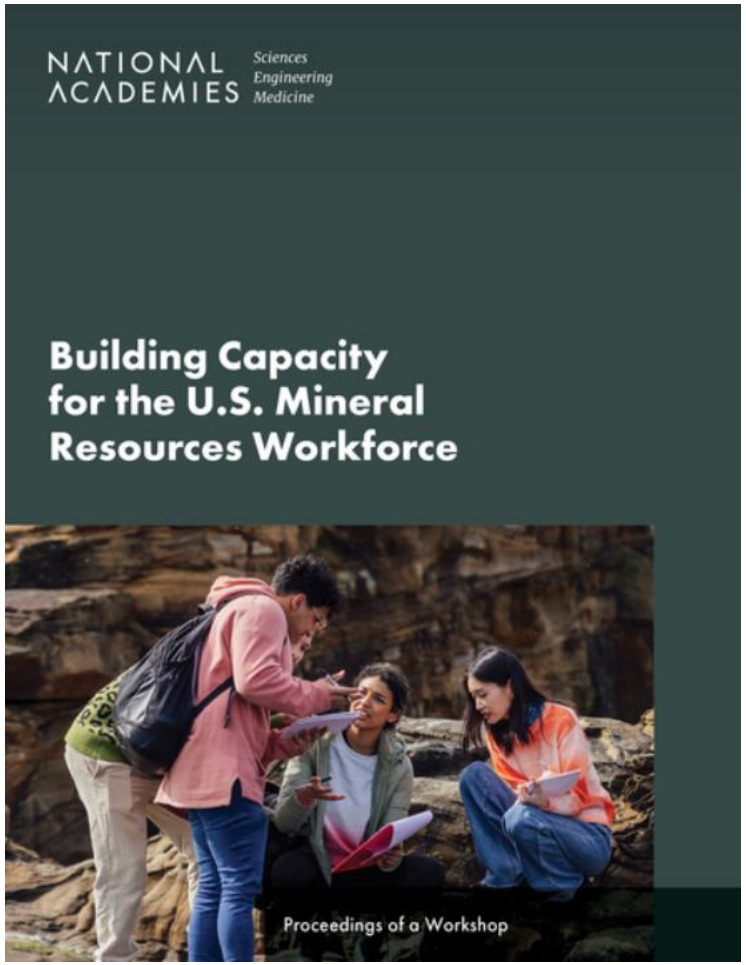
Edgar Mine: Research & Innovation Hub

- Testing autonomous vehicles, sensor networks, and human-robot interaction in real-world underground environments.
- Research on automated excavation, ground characterization, and disaster response robotics.
- Development of advanced mine planning software and real-time monitoring systems.

New Entrepreneurship and Innovation Spaces

Rebuilding the Workforce

- Address workforce gaps to rebuild global competitiveness in mining, minerals and metals processing.
- Invest in R&D (public & private)
- Credibly establish positive industry image, enhance recruitment
- Global McKinsey study of people aged 15 to 30 years: 70% *“definitely wouldn’t”* or *“probably wouldn’t”* work in mining



https://doi.org/10.17226/27733

Mining and Minerals Related Degree and Leadership Programs

Undergraduate

Electrical Engineering

Geological Engineering

Geophysical Engineering

Materials Engineering and Metallurgy

Mechanical Engineering

Mining Engineering

Robotics Minor

Graduate

Carbon Capture, Utilization and Storage

Data Science: Earth Resources

Geochemistry

Geology and Geological Engineering

Geophysics and Geophysical Engineering

GIS and Geoinformatics

Metallurgical and Materials Engineering

Mineral and Energy Economics

Mineral Exploration

Mining Engineering

Mining Industry Management

Nuclear Engineering

Power Systems

Robotics

Space Resources

Tailings Engineering

Underground Construction and Tunnel Engineering

Honors and Scholars

Future Energy Scholars

Grand Challenges Scholars

Grandey Leadership by Design First-Year Scholars

Grewcock Presidential Scholars

Mines Professional Education: From Fundamentals to the Future

Mining Core (*Mining Foundations for Non-Technical Professionals*): Designed for those new to mining or in adjacent roles, this 12-hour self-paced foundational program builds a strong understanding of the mining industry from a technical and business perspective.

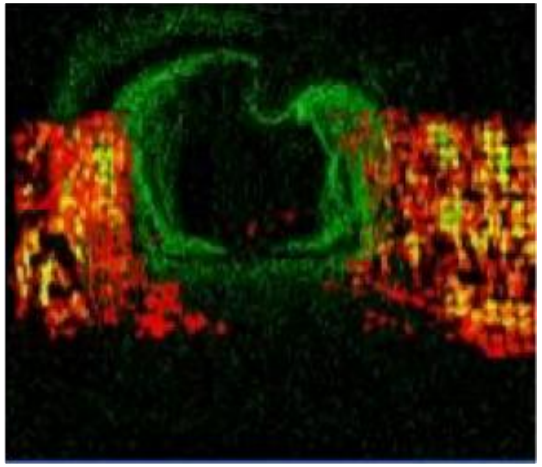
Three Courses:

- **Inside Mining:** Lifecycle of a mine, mining methods, mineral deposits, and processing
- **Business of Mining:** Project funding, risk evaluation, due diligence, and technical communication
- **Sustainability in Mining:** ESG, water, biodiversity, tailings, mine closure, DEI, and community engagement

Audience:

Professionals entering the mining sector or needing a comprehensive, non-technical overview

Mines Professional Education: From Fundamentals to the Future



Future Mine (*Advanced Executive Training for Technical Leaders*): This immersive, cohort-based program is designed for technical executives and innovation leaders navigating the rapidly evolving mining landscape. The program is delivered in person and spans one week.

Program Themes:

- **Automation & AI:** Robotics, autonomous vehicles, data lakes, sensor telemetry
- **Green Technologies:** Decarbonization, water circularity, low-impact innovations
- **Strategic Decision-Making:** Governance, ethics, risk, value chain optimization
- **Future Workforce:** Skills agility, continuity of knowledge
- **Field Visit:** Experiential learning at an experimental mine site

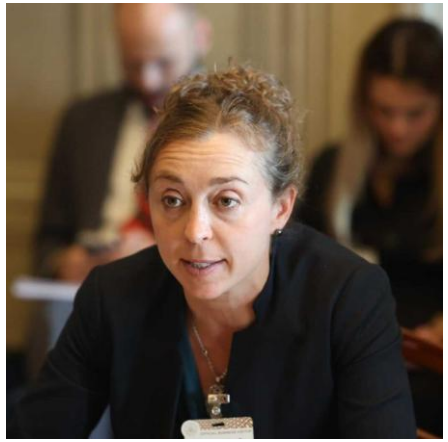
Audience:

Senior technical leaders, innovation managers, and decision-makers in mining

Critical Minerals & Mining Thought Leadership

Go-To Partners for Expertise

- Congressional Testimony & Briefings
- Federal Convenings & Workshops
- Payne Institute for Public Policy Convenings



Critical Minerals & Mining Thought Leadership

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Partnerships & Coalitions

- Policymakers
- Industry
- Mining Schools Coalition
- NGOs & Think Tanks

UTILITY DIVE

OPINION

Mining for talent: Education's crucial role in America's clean energy, mineral-driven future

Recognizing the importance of critical minerals for a more sustainable and secure future, the U.S. government has intensified its support for responsible mining and its workforce.

By Misael Cabrera and Bill Zisch

In an era defined by rapid technological advancement, rising global tensions, escalating environmental concerns and the quest for sustainable energy, our nation's future hinges on strategic investments in the critical minerals sector. Minerals are the foundation of modern technology — powering defense systems, medical equipment, infrastructure, microprocessors, transportation, and energy, particularly green energy. However, in the pursuit of critical mineral independence, perhaps our most crucial resource is a skilled mineral workforce.

Critical Minerals & Mining Thought Leadership

Go-To Partners for Expertise

- Congressional Testimony & Briefings
- Federal Convenings & Workshops
- Campus Convenings

Partnerships & Coalitions

- Policymakers
- Industry
- Mining Schools Coalition
- NGO & Think Tan

Policy Leadership

- Mining & Minerals Workforce
- Mining & Minerals Innovation
- Community Engagement
- Interagency Coordination
- Mineral Markets & Stockpiles
- International Capacity Building
- Space Resources

Hickenlooper Announces Bipartisan Effort to Secure American Critical Minerals

GOLDEN, COLO. – Today, in a speech at the Colorado School of Mines, U.S. Senator John Hickenlooper announced the introduction of two bipartisan bills with U.S. Senator Thom Tillis to guide a national strategy on a clean, responsible, and innovative approach to critical mineral sourcing. The bills kickstart an effort to establish American dominance in critical minerals.

Hickenlooper Press Release, September 13, 2024

A SCIENTIFIC, DATA DRIVEN APPROACH TO INFORMING THE GLOBAL ENERGY FUTURE

Leverages Mines' broad technical expertise throughout the energy system to create a comprehensive understanding of future energy opportunities and challenges

- Convening Thought Leaders
- Research
- Education
- Events
- Global partners

Industry Partnerships & Collaborations

- Extensive network of industry-university consortia, connecting with hundreds of companies.
- Strong partnerships with federal labs (DOE, USGS, NASA, NIST) and governmental agencies.
- Collaborative research, talent development, and policy leadership.

ASPPRC Advanced Steel Processing & Products Research Center

CENTER FOR WELDING JOINING & COATINGS RESEARCH
COLORADO SCHOOL OF MINES

Collaborations are in our DNA

USGS-Mines Energy and Mineral Resources Facility on Mines Campus
Authorized and appropriated. Construction underway.

Partnering with Mines

- Hire our students
- Engage with our consortia and research centers
- Join in symposia, thought leadership convenings
- Join Mines Energy Alliance
- Use our R&D facilities
- Sponsor research / collaborations
- Facilitate joint appointments
- Provide internship and co-op opportunities
- Sponsor an innovation challenge focused on company interests
- Connect with the Venture Center
- Take advantage of Mines ProEd
- Co-develop new facilities and research projects

Discussion