

MINES MAGAZINE

For Colorado School of Mines Alumni and Friends • Spring 2021



Igniting the
ENTREPRENEURIAL
spark

Mines is enhancing its business-focused educational opportunities—with alumni fanning the flame

Plus:

Innovative technological solutions provide new and improved opportunities

Mines alumni share their thoughts on ambition, giving back and life itself

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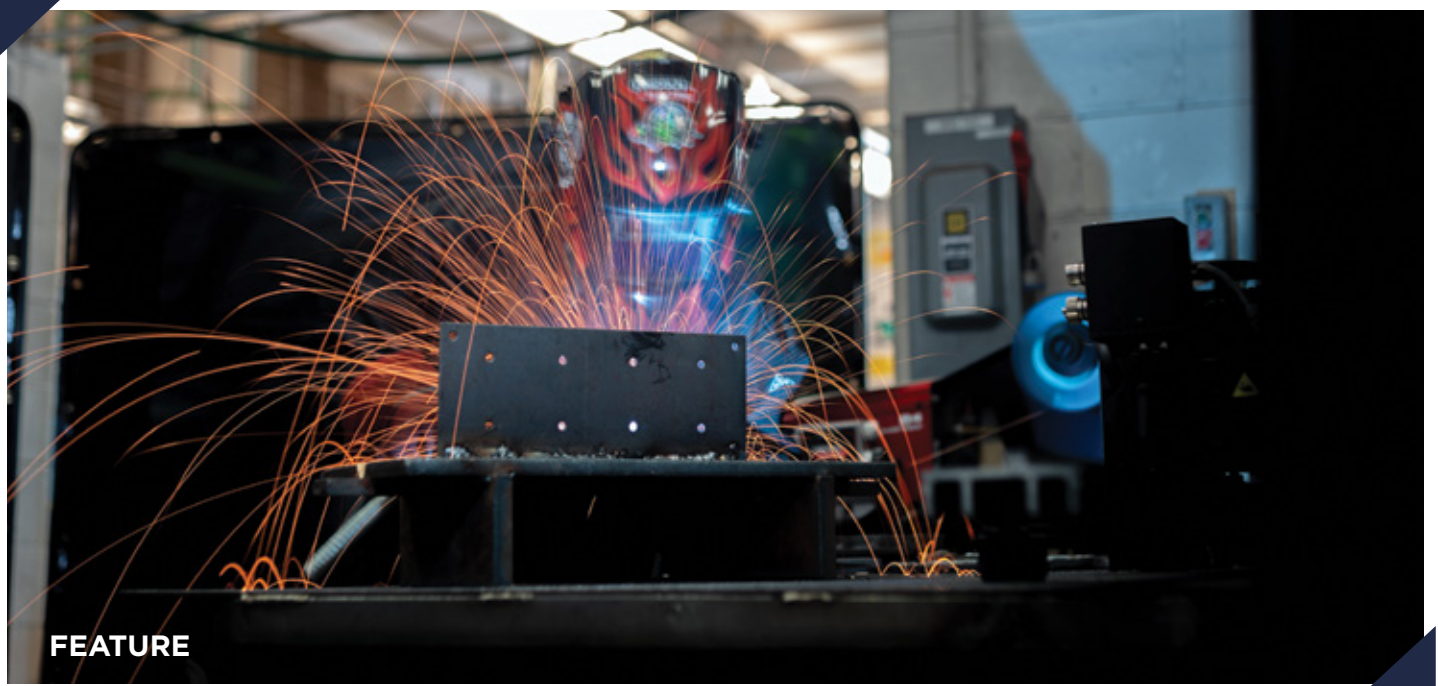
@COLORADOSCHOOLOFMINES



There's nothing quite like the glow of Guggenheim to spark the nostalgia of being on the Mines campus.

- ▶ Follow Mines on social media for more beautiful shots of Golden and the Mines campus, and keep up with everything happening with your fellow Orediggers.





FEATURE

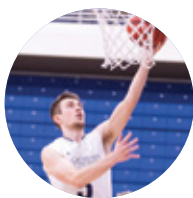
IGNITING THE ENTREPRENEURIAL SPARK 18

While Mines has long supported entrepreneurship and innovation, it's now being brought to the forefront—with Mines alumni and supporters leading the way.

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- Two new space-focused minors
- Mines' first biomedical and biotech undergraduate degree
- Mines recognized for a commitment to diversity, inclusion and access



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SKILL SET



George Saunders '81 shares his scientific approach to writing and discovering humanity's depths. **30**

ON THE COVER: Alex Hansen '12, a current metallurgical and materials engineering master's student, works in Mines' welding lab.

Unlock Oredigger dreams with scholarships

Students are the body and soul of our institution, and ensuring their success at Mines and beyond is at the heart of all our efforts.

Making a Mines education possible by removing financial barriers through scholarships is a cornerstone of the Campaign for MINES@150. Alumni can help give students the same quality, world-changing education they received by donating to Mines scholarship funds.



“ Thank you for making these dreams possible for me and plenty of my peers. ”

Parmida (Mida) Mahdavi
Engineering Physics, Class of 2024



“ Seeing the great success from previous and fellow scholars shows me that any dream is possible, no matter how big. ”

Charles O'Brien
Mechanical Engineering, Class of 2021



“ Without you, I would not be at this school working towards my dreams, and no amount of words can express how meaningful that is to me. ”

Julia Vaughn
Chemical Engineering, Class of 2023

Learn more about the impact of scholarships and how you can help make dreams come true at campaign.mines.edu/scholars.

EDITOR'S LETTER

Celebrating ingenuity and ambition

I get notes from Mines alumni all the time telling me of their latest business ventures, an interesting product they've developed and how they've included other Orediggers in their achievements. In fact, that's how many of the stories featured in the magazine come to be—a short note about a unique idea that leaves me wanting to know more.

The ingenuity and ambition I've seen from Orediggers is seemingly limitless, and those are the most exciting stories to tell. While *Mines Magazine* is in part a way to keep alumni up-to-date with what's happening on campus and stay connected to your alma mater, it's largely a publication that celebrates you—your big ideas that help solve complex problems, the distinctive skills that have enabled you to not only meet but exceed expectations beyond Mines and the connections you've made and maintained over the years to help you meet your goals.

Many of the stories in this issue focus on those celebrations. Our cover story, while sharing how Mines is enhancing entrepreneurial education on campus, is driven by the experiences and support Mines alumni know—and have proven—are essential for preparing students for a successful future. The issue includes a look at some alumni-led projects that are changing the way we interact with the world and improving everyday technologies. We even sat down with some inspiring alumni to get their thoughts on their personal journeys and perspective on life.

I hope you'll join me in celebrating your fellow Orediggers' hard work and unique perspectives as you read this issue. And I can't wait to hear from more of you about the work you're doing and the interesting avenues you've taken.



Ashley Spurgeon



MAGAZINE NEWS

Mines Magazine's Spring 2020 issue won the grand gold award in the "publishing improvement" category in this year's Council for Advancement and Support of Education's District VI Institutional Awards. The award recognizes print university magazines that have undergone significant changes over a two-year period and demonstrate outstanding improvement in the publication.

The category's judges commented, "Mines did their homework and crafted a publication that meets their voice and vision in a new way. It's a

well-designed piece. Bringing readers into the planning process is a nice touch for the audience's engagement. Content is rich, diverse, and still concise for a busy audience."

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CREATING BUSINESSES, LEADERS AND PROSPERITY

Mines graduates are helping prepare future entrepreneurs and business leaders

“Success stories abound throughout America,” Warren Buffett wrote in his most recent Berkshire Hathaway shareholder letter. “Individuals with an idea, ambition and often just a pittance of capital have succeeded beyond their dreams by creating something new or by improving the customer’s experience with something old.”

Many of you have stories like these. Stories of hard work and dedication. Hanging your own shingle or staking your claim. You created something new, and in the process, created prosperity for a growing network of employees, partners, suppliers and neighbors.

Frank Labriola '52 and his wife Mary have their story. Frank graduated from Mines with a professional degree in metallurgical engineering and with time, recognized that what he really wanted to do was start his own business. He put everything he had into founding PIMALCO, an incredibly successful manufacturer of lightweight hard-alloy aluminum for the aerospace industry.

Frank and Mary believe that companies driven by leaders and innovators with both engineering and business smarts, and who take care of their people, are at the core of this country’s prosperity. They want Mines to inspire and produce that next generation of entrepreneurs and industry leaders and made a transformative gift to ensure that happens.



We will soon see the impact of their gift when we open the Labriola Innovation Hub in late 2022. It will contain makerspaces, team meeting spaces, the Thorson Capstone Lab and the McNeil Center for Entrepreneurship and Innovation. The Innovation Hub will be the building in the Labriola Innovation Complex, which began to take shape in Fall 2020 with the completion of state-of-the-art project-based classrooms in McNeil Hall.

Mines students will start and finish their education in the Labriola Innovation Complex. It will have everything they need to move their projects and ideas from vision to reality. This complex will solidify Mines as a unique, top-of-mind, first-choice option for future generations of Orediggers. It will project our continued commitment to learning-by-doing and preparing future innovators and industry leaders.

Frank and Mary know entrepreneurs, innovators and business leaders can, as Buffett puts it, create “a spread of prosperity that benefits all of humanity.” As you’ll see in the pages of this issue, Orediggers have been doing this long before now, and thanks to the Labriolas and many of you, we’re going to see that continue and grow.

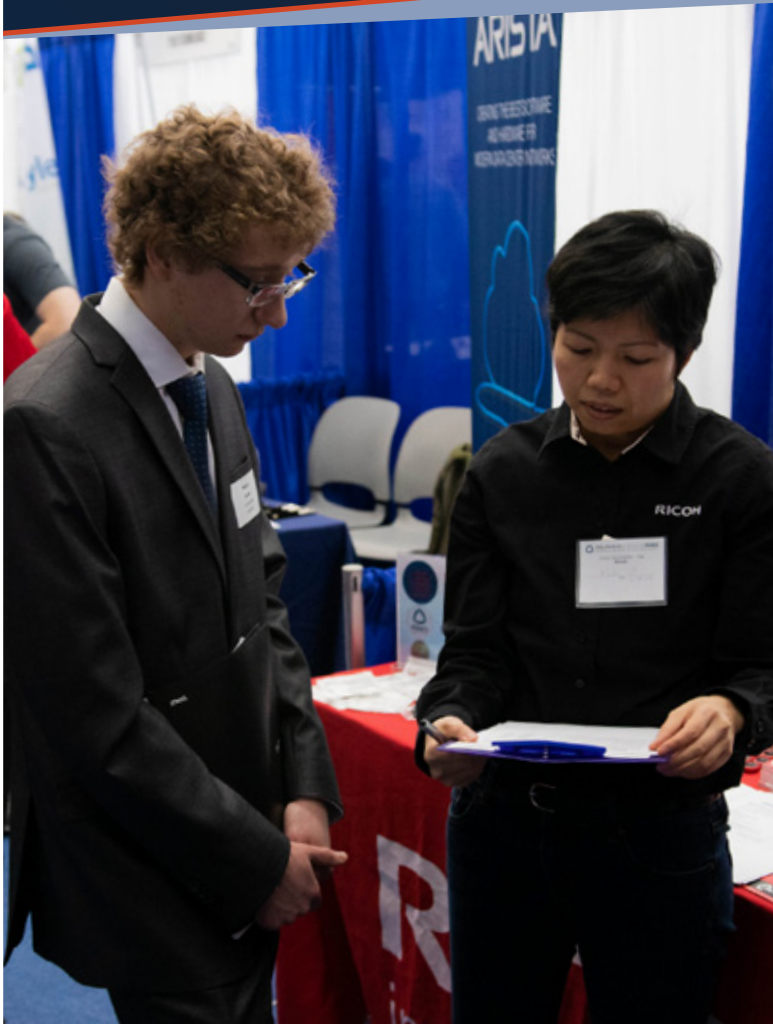
Paul C. Johnson
President and Professor

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FALL CAREER DAY

September 14, 2021

Employer registration will open in mid-June.



Attract the best and brightest engineers for your company. Don't miss out on this huge event to interact with 2,000+ Mines students and alumni.

For more information, contact Associate Director of Employer Relations **James Saulsbury** at 303-273-3205 or jsaulsbury@mines.edu.

CAREERS.MINES.EDU

NOTHING BUT NET

The Oredigger basketball teams pull off impressive seasons

The season may have looked different without fans in the stands and other health precautions in place due to the ongoing COVID-19 pandemic, but the Oredigger basketball teams still made an extraordinary showing on the court in the regular season. Here are the highlights:

Men's basketball

- The Mines men's basketball team pulled off a 13-0 winning streak before suffering a loss to Colorado Mesa, who was No. 7 in the nation at the time.
- The team held the top spot on the National Association of Basketball Coaches Top 25 poll for six consecutive weeks.
- The Orediggers ended the regular season at 16-2 and were selected to the 2021 NCAA Division II Men's Basketball Tournament, earning the No. 2 seed in the West Region and a first-round bye.
- This season's NCAA Tournament selection is Mines' eighth consecutive NCAA selection, and the Orediggers have been to the tournament 11 times overall since 2010.



Women's basketball

- The Mines women's basketball team claimed the Rocky Mountain Athletic Conference championship, marking the team's first RMAC crown in six years and second conference championship in program history.
- Ending their regular season 15-3 overall, the Orediggers claimed their highest national ranking in program history, rising to No. 14 in the media poll sponsored by D2SIDA and No. 24 on the coaches' poll.
- For the first time in five years, the team earned a spot in the NCAA Tournament as the No. 1 seed in the West Region but unfortunately had to pull out of the tournament due to COVID-19 protocols.
- This is the third time the Oredigger women's basketball team has advanced to the national tournament in the history of the program.
- Brittany Simpson became the winningest coach in the history of Mines women's basketball at the start of her ninth season on Dec. 4, 2020, in a 68-53 win over South Dakota Mines.



► For more on Mines Athletics, visit minesathletics.com.



○ A NEW GLOBAL ENERGY FUTURE INITIATIVE

■ In January 2021, Mines launched a new initiative aimed at bringing together some of the world's foremost global thought leaders and decision-makers in the energy sector to discover, collaborate and network around key aspects of our energy future.

The Mines Global Energy Future Initiative will produce annual programming focused on the role of oil and gas, renewable energy, carbon capture utilization and storage, supply chain transparency, emissions monitoring, circular economy and more—themes that all reflect Mines' scientific and technical expertise across the energy system and demonstrate the university's cradle-to-cradle approach to creating a sustainable global energy future.

"Mines is uniquely positioned to lead and facilitate discussions about the world's global energy future," said Mines President Paul C. Johnson. "In collaboration with academia, industry, government and civil society partners, we hope to provoke thoughtful conversations and data-driven research that identifies the challenges and opportunities ahead."

▶ To kick off the initiative, Mines hosted a dialogue with Pulitzer Prize-winning author Daniel Yergin. Check out the recording of the conversation at mines.edu/energyfuture

○ INTRODUCING MINES' FIRST BIOMEDICAL AND BIOTECH UNDERGRADUATE DEGREE

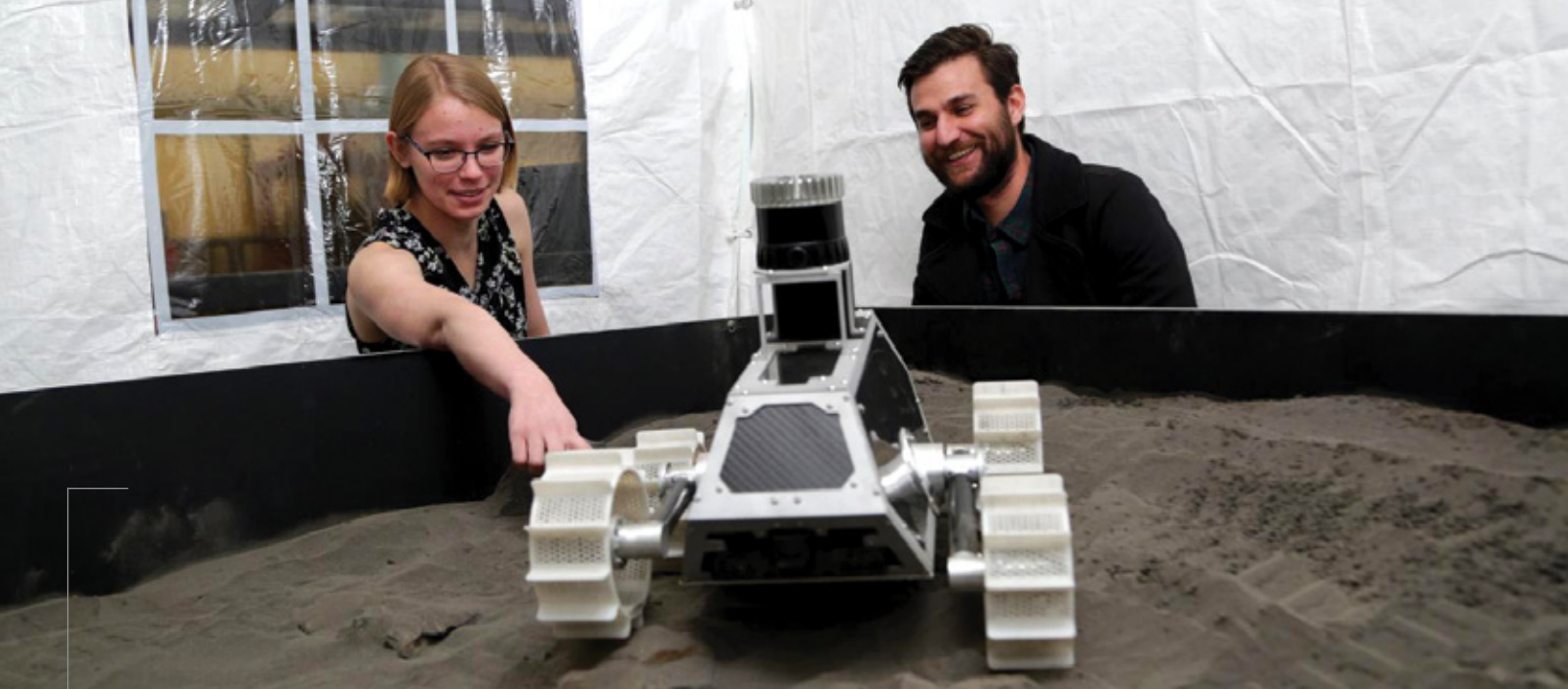
■ In Fall 2021, Mines will enroll students in a new undergraduate degree program to harness the power of biology and mathematics to address the next generation of challenges in health care, energy and the environment. The Bachelor of Science in Quantitative Biosciences and Engineering will provide a rigorous Mines education focused on the quantitative skills and mindset needed for impactful careers in medicine and biomedical fields, as well as bioenergy, biomaterials, bioengineering, biomechanics, bioenvironmental and biophysical engineering.

Mines Provost Richard C. Holz said, "Student demand for an undergraduate biology program at Mines has steadily grown over the years, stemming from their interest in pursuing a medical profession, graduate programs in cell biology, immunology, genetics and more, and careers in the thriving biotechnology industry."



CONNECTIONS

▶ Have you run into a fellow Oredigger in an unusual place? Gone on a trip with classmates? Visited campus to share your expertise? We want to know all about it! Send us your connections at minesmagazine.com/connection. •



NEW SPACE-AIMING UNDERGRADUATE MINORS AND A TEACHING MINOR

Three new minors will give undergraduate students more ways to tailor their Mines experience to serve their interests and career ambitions. Aerospace engineering, space mining and teaching minors will be offered in Fall 2021 after being approved by the Mines Board of Trustees in February 2021.

Aerospace Engineering

As the aerospace industry continues to grow in Colorado, it now represents five of the top 10 employers for mechanical engineers in the state. While a full degree in aerospace engineering is not a requirement for these jobs—as shown by the number of Mines graduates currently working in the industry—a dedicated minor will help make Mines students even more competitive in the field. The Aerospace Engineering minor is designed to support students interested in aerospace engineering careers who are majoring in mechanical engineering, electrical engineering, metallurgical and materials engineering, physics and other areas.

Space Mining

Mines is the only academic institution in the U.S. to currently offer an advanced degree in Space Resources. This new minor will also allow undergraduate students at Mines to get a flavor of what is to come in the future of both mining and space exploration. This developing field attracts interest from a wide range of students and industries, including many nontraditional mining disciplines. The Space Mining minor will provide Mines undergraduates with a strong foundation of knowledge to make an immediate impact as they enter pertinent industries. The minor is believed to be the first in the world—and the solar system—with this specific focus.

Teaching

In addition to the two space-focused minors, a new Teaching minor will offer even stronger recognition of a student's preparation for a teaching career and include a substantial K-12 classroom component.

CONVEYING NEW IDEAS

A new podcast shares stories about Mines research

Earlier this year, Mines launched a new podcast to share insightful conversations about the latest in Mines research. *The Conveyor* brings listeners in-depth conversations with unique perspectives on some of the most pressing challenges and emerging ideas in engineering and science.

The podcast covers discussions ranging from how Mines researchers are advancing knowledge for the betterment of society and industry through multidisciplinary collaboration and unique partnerships to more specific ideas such as how the need for oil and gas in the world's energy portfolio and skilled petroleum engineers will still play an important role in our energy future for many years to come.

► Learn more about *The Conveyor* and listen to the latest episodes at mines.edu/communications/the-conveyor

The
Conveyor

► John Spear MS '94, PhD '99 was featured on Colorado Public Radio on Feb. 16, 2021 to talk about Colorado's newest national natural landmark: a toxic sulphur cave. •



MINES' SCHOLAR COMMUNITIES

Florence Caldwell Achievement Scholarship

Named for the first woman to graduate from Mines, this scholarship is awarded to three incoming first-year students who demonstrate a commitment to the legacy and ideals of Florence Caldwell to help pay for tuition, books and fees.

Grewcock Presidential Scholars Program

Founded by Debra and Bruce Grewcock '76, this program cultivates the next generation of world-changing leaders. The Grewcock scholarship pays for four years of tuition and fees and is one of the most prestigious and intensive scholarships offered at Mines.

Harvey Scholarship Program

Established in 2009 with a generous gift from the Hugh and Michelle Harvey Family Foundation, this program recognizes and rewards merit in academic performance, outstanding character and leadership and fosters excellence in academic and life pursuits.

Vanguard Community of Scholars

An invitation-only program, Vanguard is for high-potential students possessing leadership skills and the desire to improve our world through science, technology, engineering and mathematics. This program is made possible through the guidance and resources provided by the Women in Science, Engineering and Mathematics (WISEM) Program at Mines.

IMMERSIVE LEADERS

Four signature scholar communities support students and enhance the Mines community

BY JASMINE LEONAS

In the world of higher education, Mines is not a large university. But even with more than 6,000 students, it's possible to get lost in the crowd. That's where the four scholar communities at Mines come in.

Undergraduate students accepted into these communities—either as Caldwell, Grewcock, Harvey or Vanguard scholars—gain access to unique leadership development and service opportunities, in addition to financial aid. And they become part of a tight-knit group from the start of their time at Mines.

Students in these communities are able to take part in workshops and events tailor-made for them, emphasizing skill development and campus involvement.

"It's been really cool to get outside perspective on what leadership means to other people," said Katie Lake, a first-year mechanical engineering student who is both a Grewcock and Vanguard scholar. "I feel like I've learned a lot about different styles of leadership and ways to work with other people. And it's very applicable to my classes at Mines."

For electrical engineering student Ben Baize, being a Grewcock Scholar means being able to find a community at a college far from his home state of Indiana.

"I knew zero people in Colorado before coming to Mines," Baize said. "This scholarship specifically connected me and bonded me to these nine other individuals. I feel like without this experience, I would've struggled with meeting new people, but being part of Grewcock, it hasn't been hard."

CONNECTIONS

- ▶ Jennifer Miskimins MS '00, PhD '02 was featured on the first episode of Mines' podcast *The Conveyor*, discussing how oil and gas plays an important role in our energy future. •

Taking part in extracurricular activities is an essential part of the scholar programs. Baize said he sought out opportunities because the Grewcock program encouraged him to follow his passions, such as joining the rock climbing club. But when most of the club's events were canceled due to COVID-19 restrictions, he had to take even more initiative. Instead of giving up on his interest in rock climbing around Golden, Baize emailed the club and was able to meet up with other members—physically distanced, of course—to do some climbing. He never would've been so proactive in pursuing his interests if not for the encouragement of the Grewcock program.

While the COVID-19 pandemic has limited certain hands-on experiences, students are still able to meet virtually or in smaller groups. Lake said that while it's been disappointing to not be able to visit companies in person and see examples of leadership in the real world, with key experiences in the Grewcock program, she is still able to put into practice what she's learning about leadership via Zoom or during outdoor meetings on Kafadar Commons.

With community involvement being a large component of all the scholar programs, Lake ran for programming chair for her residence hall, which she said she wouldn't

have done otherwise. And she said many of her fellow scholars in the Grewcock and Vanguard programs have similarly pursued positions around campus. The scholar communities teach the principles of leadership, but they also encourage students to put them into action.

"Leadership isn't just something you have and doesn't grow," Lake said. "The more you practice it, the better you're going to get."

And the more she gets involved on campus because of her scholar communities, the more surprised she's been by how the programs enhance the Mines community as a whole.

"I expected the talks and the workshops, but I never expected the aspect of getting close to people in the community and making a difference," she said.

Beyond graduation, being part of a scholar community sets Mines students up for a successful career and the potential to make valuable contributions to the world. According to Andrew Flynn, director of alumni engagement, "Scholar communities allow Mines to graduate engineers that understand teamwork, are prepared to lead and recognize the value of contributing to their surrounding communities."



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INTELLIGENT DESIGN

Turning wheelchairs into smart, modern devices

BY SARAH KUTA

Four years ago, Jered Dean '04, MS '09 got an unexpected call from his brother, Barry Dean, asking for help.

Barry, an award-winning songwriter based in Nashville, was worried about his daughter Katherine, now 20, who has cerebral palsy and uses a motorized wheelchair. He'd recently heard about a woman whose wheelchair tipped over while she was driving it, causing serious injuries. He wanted to prevent something similar from happening to Katherine and, maybe someday, other wheelchair users.

But where to begin? He figured if anyone would be able to design and build a brand-new system for making power wheelchairs safer, it would be his younger brother Jered. With two engineering degrees from Mines and experience in industry and academia, not to mention a passion for improving the lives of others, Jered was eager to help. He flew from Denver to Nashville and spent a long weekend with his brother, studying Katherine's wheelchair and talking through the problem.

"The wheelchairs themselves can weigh 300 or more pounds without a person in them, and most of them will tip over with as little as a few inches of drop-off from a curb," said Jered. "That can be catastrophic for the person in the chair. The injuries from tip-overs and collisions are serious."

That weekend project in early 2017 became an all-consuming passion for the two brothers. After developing some simple prototypes and experimenting with different technologies, Jered eventually scaled up to a sophisticated hardware and software platform that attaches to a power wheelchair and helps users avoid collisions and sharp drop-offs while



Photos by Brad Swonetz

CONNECTIONS

- ▶ In March 2021, M Club Denver and John Law '16 hosted a virtual beer tasting and tour with New Terrain Brewing, founded by Josh Robbins '95, MS '00, PhD '03 and Kaylee Robbins PhD '13. •



maintaining their independence. The two brothers named the new device LUCI, a nod to Katherine's favorite Beatles song, "Lucy in the Sky with Diamonds."

Today, LUCI is available to wheelchair users around the country. This revolutionary device fills a critical gap in the power wheelchair industry, which has largely focused on improving wheelchair suspension and alternative driving mechanisms (for users who can't steer a traditional joystick with their hands).

"There was really cool stuff going on there, but in terms of actual electronics and integrating the wheelchair into the modern world, there just wasn't anything," said Jered, who directed Mines' engineering and computational sciences capstone design program before co-founding LUCI.

LUCI is an after-market accessory that uses millimeter wave radar technology, stereo vision cameras and custom sensors to analyze the wheelchair's surroundings and prevent it from colliding with other objects and avoid dropping off curbs or ramps. LUCI can smoothly increase and decrease the chair's speed to help keep the user safe, even bringing the chair to a complete stop if necessary. The system can also sound a precautionary alarm if the wheelchair is at risk of tipping over, as well as send out alerts to specific loved ones if the chair is upended.

Each LUCI system incorporates the user's steering reaction time and features Wi-Fi, cellular and Bluetooth connectivity. Users can view their LUCI data—and share it with others, if they choose—via a special mobile app and website.

"It adds a brain and connectivity to that wheelchair," Jered said. "We turn a dumb wheelchair into a smart, connected modern device."

Many of this young company's 15 employees attended Mines, including LUCI's first employee, senior engineer

"THE WHEELCHAIRS THEMSELVES CAN WEIGH 300 OR MORE POUNDS WITHOUT A PERSON IN THEM, AND MOST OF THEM WILL TIP OVER WITH AS LITTLE AS A FEW INCHES OF DROP-OFF FROM A CURB. THAT CAN BE CATASTROPHIC FOR THE PERSON IN THE CHAIR. THE INJURIES FROM TIP-OVERS AND COLLISIONS ARE SERIOUS."

Karl Grueschow '17, a nontraditional student who earned his mechanical engineering degree in his 40s.

They're valuable members of the LUCI team because of the technical rigor and hands-on learning experience they gleaned in Golden, Jered said, as well as Mines' emphasis on using innovation, entrepreneurship and engineering for good.

"There were a lot of professors at Mines who were very forward-thinking and, like Jered, were looking out into the world and trying to figure out, 'How do we fix things that we're facing right now? How do we improve life?'" Grueschow said. "We were always encouraged to think larger than ourselves."

The LUCI team continues to improve the device, including expanding its compatibility with as many different power wheelchairs as possible. They hope their invention helps move the wheelchair industry forward while also sparking broader conversations about accessibility and inclusion in tech. LUCI helps bridge the divide between people living with disabilities and modern technology, while at the same time opening the door for new mobility-related research breakthroughs and inventions.

"Katherine and the other folks we work with every day have been left behind when it comes to technology," Jered said. "And they deserve better."

- ▶ Amanda Field '20 and Claire Knight '20 started A&C Designs Company, a small woman-owned apparel brand aimed at empowering and inspiring women in science, technology, engineering and math. •



Photo courtesy of Boom Supersonic

THE BIG BOOM BY ASHLEY SPURGEON

Supersonic air travel is once again within reach—with faster, greener and safer technology

Flying faster than the speed of sound may still seem futuristic for the average person, but nearly 20 years after the first commercial supersonic aircrafts retired their wings, what once sounded like science fiction might once again become a reality. Thanks to technological advances and innovative minds, we are on the cusp of a new generation of travel that will provide people with the ability to traverse the globe faster and more often while minimizing adverse effects on the planet.

One company in particular, Boom Supersonic, is keeping the dream of ultra-fast travel alive by creating XB-1, the first independently developed supersonic aircraft, a demonstrator they will use to build a future supersonic passenger aircraft called Overture.

We asked Boom Supersonic—and several of the Mines alumni who work there—for more details about this technology and what the future of travel might look like. This is what we learned.

Supersonic travel isn't easy, but XB-1 is optimized for performance.

One of the central design challenges engineers had to address was essentially figuring out how to put two airplanes into one. The plane must fly efficiently at high speeds while also being able to take off and land at slow speeds, so engineers were tasked with developing a design that balanced both.

At 71 feet long, XB-1's long and slender shape allows for ideal aerodynamics, and the carbon-composite frame maintains its shape under extreme heat. The aircraft's three engines provide more than 12,000 pounds of thrust to fly at supersonic speeds, and the delta wing is optimized for low-speed stability and high-speed efficiency. XB-1 also leverages a high-resolution video camera and cockpit display to give pilots a virtual window through the nose and superior runway visibility for landing.

CONNECTIONS

- ▶ In a virtual event in March 2021, Anthony Bordonaro '12, Nathan Brown '07 and Sara Foster '17 shared what it's like to live and work in Midland, Texas and gave insights into the industries and opportunities available in the city. •

And every design decision took safety, accessibility and the plane's environmental footprint into consideration—in fact, Boom Supersonic is committed to making their Overture fleet carbon neutral and capable of running on sustainable alternative fuels.

“The challenges that we face in designing a supersonic airliner that is safe, economically viable and sustainable have been growing throughout the past 50 years and is not a problem that can be solved by applying the same techniques as previous airliners,” said Allison Pelzel '17, MS '18, an aircraft performance engineer who has worked on both XB-1 and Overture. “It takes strong problem-solving skills and determination to solve each new problem—this is one of the lessons that Mines teaches best.”

Recent innovation in supersonic technology was made possible by past aerospace advancements and bringing different skill sets together.

Over the years, new ideas such as building aircraft with a carbon fiber material instead of aluminum, using computer simulations for testing instead of wind tunnels, overhauling the jet engine design and more were

key to XB-1's design, each component working together to create the safest and most efficient model.

“New technologies are allowing us to design, build and test at speeds which are increasingly only limited by the scope of our imagination,” said Benjamin Collins '12, a manufacturing engineering and CAD/PDM administrator.

Ryan McKay '07, a mechanical engineer on the project, said even his own experiences working in different industries and gaining a multitude of disparate skills allowed for new ideas when working on XB-1. “Compiling experiences from multiple industries allows one to acquire a much broader perspective on how things are done and how they can be done,” he said.

Making supersonic travel a possibility again may not be easy, but for Collins, it's worth the challenges. “We have to be brave enough to attempt our goals in the first place, humble enough to know we have much to learn to succeed and meticulous and tenacious enough to see it through to a safe and successful conclusion,” he said. “It will take a few years for the revolution to become apparent, but the world will never be the same again.”



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SAFETY IN THE CYBER AGE BY JASMINE LEONAS

With cyberattacks becoming more sophisticated, digital spaces require skilled experts to keep information safe

On the night of Oct. 7, 1996, early in the fall semester, hackers broke into the Mines network and gained access to more than 1,000 websites. Documents declassified in 2016 revealed that this attack—named Moonlight Maze—was part of a two-year campaign by Russia against the United States and is considered one of the earliest state-to-state cyberattacks ever.

Now, almost 25 years later, attacks such as WannaCry and, more recently, SolarWinds are widely known. Cybersecurity is now a regular part of business operations everywhere, and with an increasing need for more people on the front lines of the digital fight, Mines is providing the next generation of highly trained experts.

“For every IT [information technology] leader in every organization, it’s a priority,” said Monique Sendze, chief information officer at Mines.

Higher education institutions are frequent targets, Sendze said, because of the nature of their work. And because Mines often works on groundbreaking projects in conjunction with government agencies or large companies, that research can be attractive to hackers.

The increased interconnectedness of society is providing more openings for hackers, Sendze said, so cybersecurity is a bigger issue now more than ever. “There are several shifts happening in technology, with a lot of advancement in tech, like artificial intelligence, open networks,

the Internet of Things, for example. Everything is connected,” she explained. “We are creating more opportunities for increased cyberattacks.”

Because cybersecurity is becoming increasingly important—Sendze said that according to the Herjavec group, a leader in cybersecurity operations, the estimated average cost of cyberattacks in 2021 will be a whopping \$6 trillion, up from \$3 trillion in 2015—professionals who want to work in the computer science field need to be prepared.

Certain student organizations at Mines, such as the Mines Cybersecurity Club and Women in Computer Science, give students the opportunity to work on real-life computer science challenges and

CONNECTIONS

- ▶ Joseph Eazor '85, Nancy Keegan '82 and Kelly Taga '00 were panelists on the spring CEO roundtable event and spoke about building a career and growing leadership skills. •

create projects for their portfolio. And two different certificate programs— Mines Cyber Defense Certificate Program, which is offered through the Center for Cyber Security and Privacy at Mines, and the online Cybersecurity for Cyber-Physical Systems Graduate Certificate, offered through the Computer Science Department— provide opportunities for focused courses that prepare students for a career in cybersecurity.

With technology essential to the work being done at Mines, creating a secure space for research to flourish is important.

“What’s really challenging is that there’s a very delicate balance between the open and collaborative nature here at Mines and protecting against cyberattacks,” said Phillip Romig, former chief information security officer and current computer science professor at Mines. “We want our students to try new things, and we want faculty to do their cutting-edge research and work with colleagues around the world. Doing that while also protecting against well-funded, well-organized, highly motivated adversaries is what makes cybersecurity so hard sometimes.”

And with the COVID-19 pandemic, cybersecurity is especially important, with many people across the country working from home. Hackers are targeting not just organizational systems but also collaborative video meeting software such as Zoom and Microsoft Teams, Sendze said.

The best way protect against cyberattacks? Vigilance, cybersecurity awareness training and building defense systems and environments, Sendze said. “Once we come up with a new defense method, the criminals find new ways to attack. It’s a cycle that never ends. We have to continue to be on our toes.”



YOU ASKED, OUR EXPERTS ANSWERED

Jim Miller '70 asked:

Earth’s magnetic field shields much of the planet’s surface from solar wind, and some say without it, the consequences could be disastrous for living things. However, paleomagnetic studies show that the Earth’s polarity has reversed many times in the planet’s geological past. Is there a real risk of “disaster” to life on Earth when the planet’s magnetic field reverses again?

Yaoguo Li, director of the Center for Gravity, Electrical and Magnetic Studies, answered:

While there’s a consensus that the weakened or disappearing magnetic field during a magnetic reversal will cause significant disruption to Earth’s ecosystem, reliable data are scarce for statistical correlation.

A recent study published by Cooper et al. (2021) in *Science*, however, directly linked a brief partial magnetic field reversal to large-scale environmental changes and megafauna extinction about 42,000 years ago. Given the steady weakening of the Earth’s magnetic field over the last two centuries and the recent rapid movement of the north magnetic pole, it’s believed another reversal is approaching.

The changes associated with the magnetic reversal would not be a sudden event in terms of human life span since a reversal could take several thousand years to complete, so it’s not clear how the loss of protection from solar wind and UV radiation would directly impact life on Earth in the short term. In the long term, it’s believed that parts of the planet could become uninhabitable for humans. A more immediate impact on modern civilization, however, would be disruptions to power, functioning electronic devices and communication caused by the bombardment of solar wind, already a known effect during strong solar storms.

- ▶ Have a question about science, engineering or anything else? Submit it at minesmagazine.com/contact-us for a chance to be featured in this column.

- ▶ Former Mines Vice President for Research and Technology Transfer Stefanie Tompkins was appointed director of the U.S. Defense Advanced Research Projects Agency in March 2021. •



Igniting the ENTREPRENEURIAL spark

By Jenn Fields

Mines has long supported entrepreneurship and innovation, but it's now being brought to the forefront—with Mines alumni and supporters fanning the flame

He didn't realize it at the time, but in his teens, Frank Labriola '52 was laying the foundation for starting his own successful company. His journey started in Golden, where he majored in metallurgical engineering and immersed himself in the rigors of a Mines education. "Mines was a very good background, because back when I graduated from Mines in '52, it was a lot of hard work and a hard schedule," Labriola said. He went on to earn an MBA at Northwestern University, where he honed his business acumen, then served as an officer in the U.S. Navy, which he credits with teaching him leadership. Those three experiences gave him the education he would need a few decades later.





“I think I was anticipating—even though I didn’t know what I was going to do—having the background that prepares you for the venture you’re going to end up in,” Labriola said.

For Labriola, that venture was starting PIMALCO, a manufacturer of lightweight hard-alloy aluminum that supplied tubing to cable companies and extrusions to aerospace giants.

“You’ve got to want to do it—you’ve got to have that fire in the belly,” he said.

Since the very beginning, Mines has drawn students who want to earn an excellent technical education that would serve them well in their careers. But many also wanted to (and would) one day stake their own claims and build their own businesses. Labriola thinks engineers are best suited to do just that—and that Mines can be of even greater service to students by introducing them to the ideas and resources needed to pursue those dreams.

Enter a new series of facilities taking shape on campus engineered to do just that. And all of them funded, and even inspired by, alumni and supporters.

The new entrepreneurship and innovation ecosystem will be an on-campus home for everything from courses in design innovation to makerspaces to resources for both students and members of the community who are ready to

incorporate a business or seek out investors. The ecosystem will include the Venture Center and Labriola Innovation Complex, established by a leadership gift from Frank and Mary Labriola and home to McNeil Hall and the McNeil Center for Entrepreneurship and Innovation. But it’s more than just a collection of buildings—it’s a commitment. One that many believe will not only further distinguish Mines graduates in the years ahead, but the university as well.

“It provides an entire ecosystem where you start as a freshman in McNeil, and if you have some serious ideas, you can experiment and prototype in Labriola, and if you make it to the next stage, whether you’re faculty or a student or just live in Golden, you have the Venture Center, which is where the ideas meet the real world,” said Mike Beck, who along with his wife, Kelly, is the lead donor for the Venture Center and the parent of two Mines graduates.

LAYING THE FOUNDATIONS FOR FUTURE ENTREPRENEURS

Steve MacDonald ’67 was passionate and tenacious about building his business, CD-adapco, said his wife, Sharron MacDonald. But he might not have used the moniker “entrepreneur” to describe himself.

“He didn’t think that he was entrepreneurial,” she said of her husband and business partner, who died in 2015. “He didn’t use the formal

PROVIDING THE SPARK FOR A NEW ENTREPRENEURSHIP AND INNOVATION ECOSYSTEM



Frank Labriola ’52 had the fire of an entrepreneur in his belly when he took the risk of leaving a secure position at Reynolds Metal Company to start his own venture, PIMALCO. The risk was worth it, and after lots of hustle, savvy and strategy, he built a successful business that contributed to the advancement of industry and

helped make the U.S. a competitive leader in metals.

After graduating from Mines with a professional degree in metallurgical engineering, Frank earned an MBA at Northwestern University where he learned about business and management—skills he now sees as essential for Mines students today in addition to technical acumen. His vision to create an atmosphere at Mines that provides entrepreneurial leadership opportunities for students with a shared drive and ingenuity happened to coincide with that of President Paul C. Johnson, igniting the spark of inspiration for more robust entrepreneurship and innovation programming at Mines.

With a generous gift, Frank and his wife, Mary, kicked off Mines’ latest entrepreneurship and innovation

words like being a strategist or developing a strategy, but he would know what needs to be done and just do it.”

Though he didn’t call himself an entrepreneur, the Mines alumnus was incredibly successful in an enterprise he built from the ground up. The MacDonalds’ company, which designed software for advanced computational fluid dynamics simulation testing, was sold to Siemens PLM Software for \$970 million in 2016. Sharron said her husband was born to run a company, but some students might need the environment the ecosystem will provide to light that spark.

“If you provide the mindset and some facilities and you’re at a campus that endorses entrepreneurship, it validates it,” said Beck, the managing director of Regent Advisors, a corporate finance advisory and investment firm. “And then, if you give them the facilities and the curriculum to nurture that, there’s no question that you’re going to get kids who opt for that—or, you’ll get kids who go off and work for a big company for a few years and they get a good idea.”

That’s what Beck did. “I started life as an engineer, working for Exxon. I was in the oil and gas patch for maybe seven years in my 20s.” He transitioned to finance, and before long, he was investing in resources ranging from uranium to lithium. “For me, I was always an entrepreneur at heart. In graduate school, I started a company, and since then, it’s been one company after another company after another company.”

Charlie McNeil ’71 always had that self-starter drive, too, but his final project at Mines cemented it. “At Mines at that time, we were more focused on going to the big company,” said McNeil, the founder and CEO of NexGen Resources. “When I did my mining engineering senior project, we had to do our own business plan for a mining project, and that kind of sparked my interest in entrepreneurship and developing my own business.”

McNeil Hall and the McNeil Center for Entrepreneurship and Innovation are part of a gift from Charlie and Judy McNeil. “Judy and I just believe in the principles of

ecosystem to bring together collaborative, integrative spaces and foster new ideas, starting with the Labriola Innovation Complex. The complex is home to McNeil Hall, where entrepreneurship and innovation learning flourishes, and the Labriola Innovation Hub, fostering creation and new ideas. The ecosystem is rounded out by a new Venture Center focused on launching new businesses.

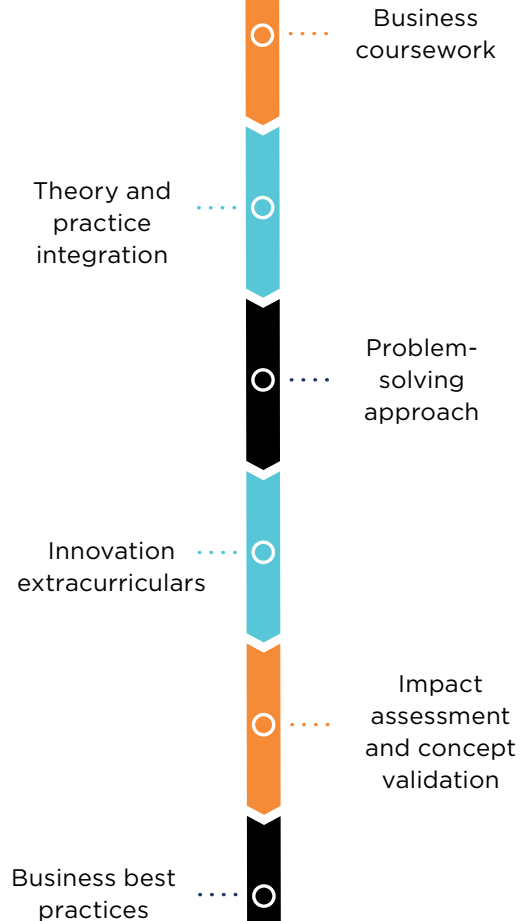
Frank and Mary’s generosity made the concept of the entrepreneurship and innovation ecosystem on campus more than a dream. Their investment inspired others, and, collectively, alumni donors are turning possibility into reality through a true, positive transformation of the culture, facilities and resources on campus.



MCNEIL HALL

With curriculum and programming across campus designed to instill entrepreneurial and business principles and foster innovative thinking, Mines students will learn the basics and best practices of entrepreneurship and come up with a variety of concepts for possible ventures. They will learn how to approach business and entrepreneurship from a problem-solving angle with hands-on experiences in addition to learning business theory.

KEY COMPONENTS

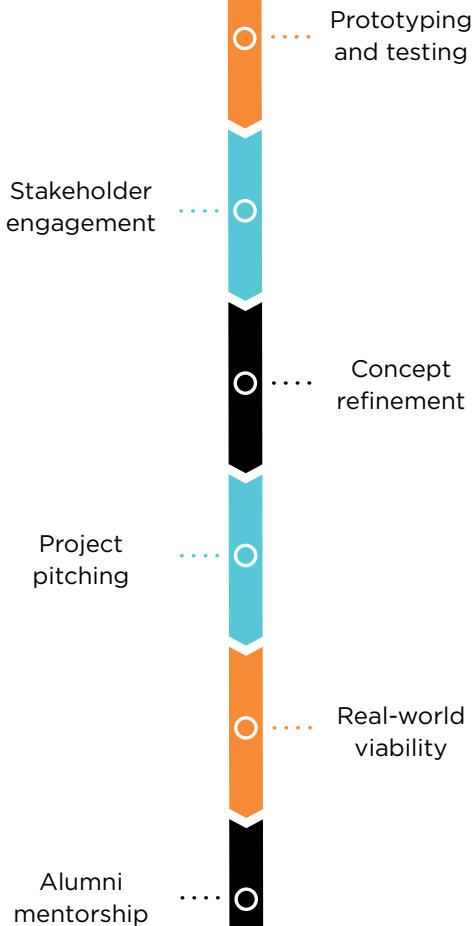




LABRIOLA INNOVATION HUB

This central component of the entrepreneurship and innovation ecosystem at Mines provides state-of-the-art makerspaces where students move seamlessly among the spaces needed to create, prototype, test and revise innovative engineering projects and is home to the McNeil Center for Entrepreneurship and Innovation, student hacker-oriented clubs and project-based competition teams.

KEY COMPONENTS



entrepreneurship as a means of personal and professional success,” McNeil said. “We just want to ensure every student at Mines has a chance to grow with hands-on instruction.”

FOSTERING INNOVATION

McNeil’s story is just one example of how a little bit of exposure to entrepreneurial thinking can change a student’s career path. “I probably get a dozen or so a year who seek me out who say, ‘I want to create something but I don’t know how,’” said Werner Kuhr, director of entrepreneurship and innovation at Mines. “These are the students who are a little less risk-averse than normal and have a little more energy and drive to try something new. And those could be the next Elon Musks. The complex lets us get a larger population that might have been a little timid at first. But if they realize this is acceptable, and even normal, that’ll give them the opportunity to take the chance. And university life is the best place to try this.”

But an education in entrepreneurship and innovation isn’t just a way to help students who want to start their own companies. It can make engineering students better at their work in the long term. Research in engineering education shows that fresh-faced incoming students are better written communicators than they are four years later when they exit college, said Dean Nieuwsma, associate professor and head of the Engineering, Design and Society Department. “For me, as an educator, it provokes me to think, what’s happening in engineering education that creates that outcome, and how do we counter that? I’m quite keen on how we retain or even nurture that spirit of engagement or doing good that incoming engineering students bring with them. And I think innovation education is the right place to do that.”

“A traditional strength of engineering education is in technology advancement, which often results in innovation, but it can also get in the way of innovation if engineers don’t have a big-picture view,” Nieuwsma said. “An innovation education helps students see the big picture—you need to marry the technical with the appreciation for business organizations as organizations. It’s understanding questions of branding, marketing, user experience,

A ‘MINES-FLAVORED’ BUSINESS DEGREE

The entrepreneurship and innovation ecosystem isn’t the only pro-business change on the horizon at Mines: This fall, students will also be able to enroll in a new undergraduate degree program, a bachelor of science in business engineering and management science. The coursework is focused in two core areas: data analytics and operations research, and business principles.

“This was definitely designed to be Mines-flavored,” said Becky Lafrancois, teaching professor in economics and



communication. All of that can get crowded by an exclusive focus on the technical dimensions of innovation.”

And that can drive a business. “Steve was always looking at innovation,” Sharron MacDonald said. “He loved talking with his customers to find out what they were working on and what their vision was. Many of them were desperate to find innovation that could move them ahead of their competition.”

Mines’ focus on entrepreneurship and innovation is also a response to the changing nature of the work engineers do.

“There are a thousand different jobs that engineering graduates go on to do. Some of them are in big, traditional tech companies that are doing engineering with a narrow technical focus—but they’re the minority of jobs,” Niesma said. Mines wants to help students understand “the realities of organizational life,” he said. “It’s about understanding colleagues, it’s about understanding customers, it’s about understanding user communities.”

Alumni outreach has helped with this, Kuhr said. “Alumni come in as adjuncts to help teach the cornerstone class, and they do a superb job, because they’re out in the business world and they know what students will want to know.”

Kuhr noted that even if you’re not running your own company, thinking about innovating to meet customers’ needs is a mindset that engineers can use to advance into leadership positions. “If they are strictly a technical problem-solver, they’re stuck in a cubicle in the back,” he said.

“If we give them a little bit of a heads up so they learn those basic entrepreneurial skills, we could have an order of magnitude impact in a matter of years,” he said. “That would probably knock 10, 20 years off their career path, they could quickly get into senior positions and have significant impact with minimal training.”

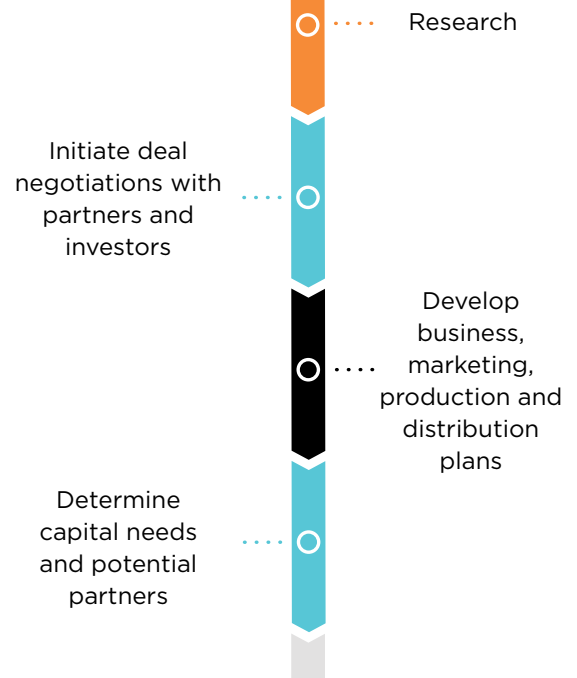
Once students have that technical and entrepreneurial education in hand, they’ll need one more thing, entrepreneurial alumni said—a willingness to take risks.

“I laid it all on the line,” Labriola said. I thought, ‘I have a backup plan, I could always go work as an engineer.’ But failure wasn’t an option in my mind.”

VENTURE CENTER

Open to students and faculty, as well as innovators outside the Mines community, the Venture Center is designed to jumpstart businesses. It will provide entrepreneurs with the space, knowledge, mentoring support and connections to other entrepreneurs and investors necessary for building sustainable and successful commercial entities.

KEY COMPONENTS

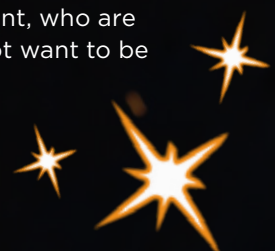


business. “It’s almost like putting parts of a computer science degree, a math degree and a business degree into one. This is a quantitative business degree.”

The curriculum has a more analytic and data-driven focus than what’s found in typical business programs. “I think there’s been an increasing emphasis on companies using data-driven modeling,” Lafrancois said. “With the big data revolution and technological advancements, there’s this real need for people who can design and use data-driven models, so there’s a

need for a degree where students can learn how to create these models but also communicate them. The real value is when you can take the output of the models you’re using and use them to make business decisions.”

“We think this is going to appeal to students who are interested in being in the Mines environment, who are math and science-savvy but who might not want to be engineers,” she said.



KEEPING SPACE CONFLICT-FREE

The head of U.S. Space Command shares his thoughts about the future of space

BY NATALIE GROSS

Over a 35-year career in the U.S. Army, Gen. James Dickinson MS '96 has seen the country's space capabilities evolve dramatically. From the space technology that played an integral role in the first so-called "space war" of Operation Desert Storm to now having the Space Force as a separate branch of the military and the reestablishment of U.S. Space Command—which Dickinson currently oversees—as a unified combatant command in 2019, the interest in everything 100 kilometers, or 62 miles, above sea level only continues to grow.

"The future, I think, is absolutely bright. There is a lot of energy and a lot of enthusiasm for space, and you see that every day," said Dickinson, who is the first Army officer to lead U.S. Space Command.

But that excitement also requires people like Dickinson to make sure new ventures remain conflict-free. "My responsibility is that I am here to deter conflict



Photo courtesy of
U.S. Space Command

in space, deliver combat power and make sure that I'm able to protect and defend on-orbit assets that support our nation, and, in particular, our nation's leadership," he said.

Dickinson said his day-to-day work includes checking on-orbit assets, or satellites, and trying to understand what other countries are doing in the space domain as well. Dickinson has served in a number of leadership positions throughout his career, including in Germany and the Middle East during Operations Iraqi and Enduring Freedom, as well as at the Pentagon and various military installations throughout the U.S. That leadership experience, as well as his technical training from Colorado

CONNECTIONS

- ▶ More than 1,200 donors contributed more than \$350,000 to Mines during #idigmynes Giving Day. •

State University and Mines, equipped him for a career in Air and Missile Defense, where he started as a second lieutenant and ultimately progressed into his current role.

That formal training in technical areas, such as when he completed his master's degree in mineral economics at Mines, has helped Dickinson understand the "sophistication" of Space Command, he said.

"Space impacts nearly every aspect of our daily lives, and our adversaries are pursuing ways to deny us the ability to operate in space. U.S. Space Command exists because of this shift in the strategic environment of space," Dickinson said. "Like any other domain such as land, air or sea, the United States must have the ability to deter conflict and, if necessary,

defeat aggression, deliver space combat power to our military forces and defend vital U.S. interests with allies and partners."

"MY RESPONSIBILITY IS THAT I AM HERE TO DETER CONFLICT IN SPACE, DELIVER COMBAT POWER AND MAKE SURE THAT I'M ABLE TO PROTECT AND DEFEND ON-ORBIT ASSETS THAT SUPPORT OUR NATION, AND, IN PARTICULAR, OUR NATION'S LEADERSHIP."

Between the recent rover landings on Mars to the growth of SpaceX in the private sector and its recent Starlink project building a satellite internet constellation, Dickinson has seen "a lot of great energy and forward movement" in the space domain, which has, in turn, brought more attention and money to the aerospace industry.

"Space is always important," he said. "From 30 years ago to today, our leverage or our ability to use space assets, whether it's for everyday life or for military operations, has just grown and grown and grown, and will continue to grow in the future."

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B.S., Mining Engineering, Minor in Metallurgical Engineering, 1982

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AN EVOLUTIONARY EDUCATION

Alumni serving on the Board of Trustees are carrying Mines into the future while preserving its long-held values

BY ASHLEY SPURGEON

Mines alumni have always played an important role in shaping the university's future, but a select few have made that role official as members of Mines' Board of Trustees.

The Board of Trustees is responsible for developing and approving the school's mission, strategic goals and objectives—no small task for the seven voting and two nonvoting members that make up Mines' board. At least four Mines alumni serve on the board at a time—a unique structure among Colorado universities—helping guide the university's future and maintaining the value of a Mines degree.

We spoke with four trustees—past and present—about the role Mines alumni play on the board and the values they work to uphold to ensure the school and its students find success long into the future. Here's what we learned.

Mines alumni have a unique perspective on the Oredigger experience that drives them to ensure others have a similar—and even better—student experience.

Although they graduated in different years, the Mines alumni serving on the board share a common Mines experience, developing the values and skill set most Orediggers share. And with such a large alumni representation on Mines' Board of Trustees, those values are always in focus.

Alumni trustees have skin in the game, said current trustee Patty Starzer '83. "The Mines alumni on the board have a unique connection to the school—we have a realistic connection in that we know what it's like to be a student there," she explained.

Former trustee Charlie McNeil '71 agreed. "We have a common bond that gets developed when you go to Mines that's like family," he said. "I think that's where having Mines alumni on the Board of Trustees is good—it's very unique that we have that ability, because we want to keep Mines that special place and carry it into the future."

CONNECTIONS

- ▶ 101 alumni recruiters attended this spring's virtual Career Day in February to talk with students about available job and internship opportunities. •



Tom Jorden '80
Board of Trustees
Chairman
President and CEO,
Cimarex Energy Co.



Tim Haddon '70
President and CEO,
International Natural
Resources Management



Charlie McNeil '71
Chairman and CEO,
NexGen Resources
Corporation



Patty Starzer '83
Co-founder, Bonanza
Creek Energy

This lived experience allows the alumni trustees to identify the aspects of the Mines experience that work well and what needs to be improved.

“The advantage of having Mines graduates is that they’ve been through the experience—they know what’s good and what’s bad and are able to improve the institution and the student experience,” said former trustee Tim Haddon ’70. “The outcomes speak for themselves.”

Success starts with close connections to industry and foreseeing what will be needed in the workforce in the near and far future.

All major decisions the Board of Trustees make are intended to give students a leg up while providing industry with the skills necessary for innovation today. Since Mines’ beginnings, the school has focused on giving students the skills needed to succeed in the workforce, while providing industry with the top talent to meet demand. As those demands have shifted over the years, the Board of Trustees—and the alumni voices within—have focused

on making sure Mines graduates were able to not only meet but exceed those expectations.

“The beauty of Mines has always been its closeness to the marketplace. Mines has always educated a student that is a problem-solver, has great analytical skills, is flexible in the way they think about problems—those are the core values and skills that are broadly applicable,” said Chairman Tom Jorden ’80. “As the business climate has changed and new industries have come to the floor, Mines—just by shifting their weight—has been able to take those core educational values and funnel students into industries that didn’t exist when I was an undergraduate. It’s caused us to identify and seek to preserve the strengths that have always been at the heart of Mines.”

“I think it’s important to recognize that there is always going to be some transition, and we want Mines to be at the forefront of supporting our students so they are equipped to meet industry needs, whether it be energy, computer science, astrophysics, chemistry or even the biomedical field. The goal is service and giving back and truly wanting

the university to be the best it can be,” Starzer said.

Ultimately, the goal is helping Mines evolve while remaining true to the university’s roots.

“Mines has really evolved over the years,” Jorden said. “That evolutionary perspective has given us the wisdom to encourage ongoing evolution. We see that we can have traditions—they can be anchoring but not limiting—and that mindset has really done a tremendous job of changing Mines with a changing world. I expect Mines to be at the forefront and continue to adapt.”

CURRENT MINES BOARD OF TRUSTEES

Thomas Jorden ’80, Chairman
Denise Burgess
Bruce Grewcock ’76
Jesus Salazar ’02
Lucinda Sanders
Patty Starzer ’83
Judith Zee Steinberg
Tracy Gardner ’96, Faculty Trustee
Hanzelle Kleeman, Student Trustee

- ▶ 25 people attended the February lunch bunch event to hear about Mines’ newly formed scholarship communities. •



Photo by Marybell Trujillo,
BelleImages

NO RISK, NO REWARD

An entrepreneur's ambition pays off

BY SARAH KUTA

Throughout her life, Jackie Haney '01 has always asked the same bold question: Why not?

While working in oil and gas, if she didn't fully understand—or agree with—a particular engineering choice or business decision, she probed deeper, asking everyone around her for insights and, often, challenging the status quo.

"I've never had a problem with taking a leap or reaching out to get advice," she said.

Haney's curiosity and self-confidence, coupled with the technical know-how she gained at Mines, propelled her to success as an entrepreneur, too. Today, Haney is a managing partner and CEO of oil and gas investment firm UnionRock. She also founded several other oil and gas firms—Versa Energy, Cobalt Oil & Gas and Copper Trail Partners—and was named one of *Denver Business Journal's* Top Women in Energy in 2019.

Always a top student in science and math, Haney pursued a chemical engineering degree at Mines, but even then, she wasn't afraid to take smart risks. As a high school senior, she cold-called then-Athletic Director Marv Kay, read off her swim times over the phone and asked for a scholarship.

CONNECTIONS

- ▶ After participating in a wounded warrior rafting trip in Utah's Cataract Canyon led by Lew Kleinhans and Fred Solheim, current graduate student Ian McBride shared that he gained a sense of comradery and support that made him proud to be an Oredigger. •

He agreed, and Haney spent the next four years swimming for Mines while studying, working multiple jobs, participating in the Society of Women Engineers and helping with graduate research.

After six years of engineering field work at ExxonMobil and Shell, Haney pivoted to finance and learned how to evaluate and underwrite property transactions at oil and gas firm Venoco.

Eventually, she struck out on her own as an engineering consultant, appraising properties for oil and gas companies, banks and private owners. Around the same time, she decided to take another big leap: cashing out her 401(k) to invest in properties herself.

"I had looked at enough properties and seen enough deals that [other companies] wouldn't do because

they were not the right fit," Haney said. "And using my field and underwriting experience, I thought, 'Somebody should buy that.'"

"THE WORST THING THAT CAN HAPPEN IS THAT YOU'LL MISS. BUT IF YOU DO, THEN AT LEAST YOU'LL HAVE SOMETHING TO LEARN FROM AND LOOK FORWARD TO."

Over time, other investors took note of Haney's business savvy and began entrusting her with their money and assets, too.

"You'll miss 100 percent of the shots that you don't take, so why not take a shot?" said Haney,

drawing inspiration from meeting professional hockey player Wayne Gretzky in 2015. "The worst thing that can happen is that you'll miss. But if you do, then at least you'll have something to learn from and look forward to."

As her own boss, she's still learning, still charging ahead and still asking "Why not?" whenever possible.

"Being an entrepreneur gives me the opportunity to explore possibilities as they present themselves and to have some control over my professional destiny," she said. "Many people back away from uncertainty and are uncomfortable with adjusting to change, but I find it enlivening to take measured risks."



Designate Mines as the beneficiary of your retirement plan and ensure that the university preserves excellence and progress for the future.



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TURNING AN ENGINEER'S LENS TOWARD WRITING, READING

A former geophysicist, George Saunders '81 discusses his scientific approach to writing and discovering life's truths

Are there laws of fiction as there are laws of physics? George Saunders '81 poses that question in his latest book, *A Swim in a Pond in the Rain*, as he breaks down seven iconic Russian short stories with the eye of a former-engineer-turned-writer and investigates the mechanics of making great stories work.

But Saunders goes beyond the technical examination of words on a page to turn his lens toward humanity to also examine what stories can tell us about ourselves and the world today. "The part of the mind that reads a story is also the part that reads the world," he writes.

We asked Saunders about his new book, writing fiction and the similarities he sees between the engineering and writing processes.

Mines Magazine: *A Swim in a Pond in the Rain* originated from a class you teach in Syracuse University's MFA program. How did you decide to translate that classroom experience into a book?

George Saunders: I'd just come back to teaching after some time off and had one of those wonderful days in the classroom when the distinction between student and teacher vanishes. As the students filed out, it really hit me, how much teaching had meant to me over the (20-some) years I'd been doing it—those many moments of genuine connection across all of the usual divides (age, gender, class, race). So, since I'm not getting any younger, I decided to put down some of the



Photo by Zach Krahmer

insights on the Russian short story that, with my students, I'd developed over the years. Before it was, you know, too late.

MM: At several points in the book, you reference your engineering background. How have your experiences and training as an engineer contributed to how you approach writing and how you teach your MFA students?

Saunders: Well, the greatest lesson I learned at Mines was that hard work is the gateway to everything. I wasn't, let's say, the most natural student of engineering. But what I learned was that short-term failure isn't the end. We have to push on. (If we don't quit, we haven't yet failed.)

CONNECTIONS

- ▶ Alumni were invited to a webinar hosted by the Payne Institute and the Mines Integrated CCUS Initiative on March 25 to hear from Mines researchers about carbon capture, utilization and storage; negative emissions; and worldwide decarbonization. •

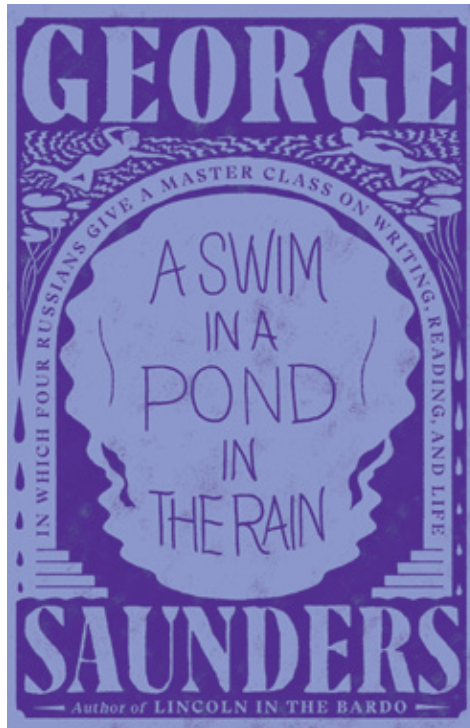
Another valuable thing I learned at Mines was the idea of approaching a task like a scientist, like a problem-solver, muttering those sacred words, “Huh, this is interesting.” You might have an idea in mind at the outset (a hypothesis or a big plan for your book), but you want to hold that pretty lightly, not be attached to it. The main job is to see how things really are (in the physical world or in the story in-progress) and respond to that. So, it’s more about exploration – moving toward a truth – than it is about knowing the truth in advance and just finding a way to prove it.

Finally, the beauty of rigor. When I got back my thermodynamics test and it had “D-, SEE ME!!” written across the top of it—that was rigor in action. (A valid response wasn’t going to be, “But I tried so hard!”) When I’ve been working on a story for four years and it still isn’t any good, I don’t get to say, “Yes, but I’ve put in the required amount of time.” Instead, I always recall that Mines mantra, “No partial credit.” It was good to learn that, with the help of my Mines professors, when I was still young.

MM: Writing and engineering are often seen as dichotomous disciplines, but it could be said that they are simply different ways of interpreting one’s place in the world and seeking a better understanding of the problems we strive to overcome. Do you agree with that, and what do you think are the intersections between writing and engineering?

Saunders: I do agree with that. One thing they have in common is the notion that to solve a big problem is to solve a lot of smaller problems. That’s a very powerful thing, since it always offers the problem-solver a way to proceed—no need to get stuck in the conceptual/worrying phase—just break the thing into parts and get going.

Also, in both disciplines, there’s that essential stage where you are simply looking at a thing unaffectedly, trying to really see it, with as few concepts or projections about it as possible. Then, a reaction arises—an instinct, a hypothesis, a sense of how to proceed. But that first step is so important, in so many areas of life. Can we see a thing clearly and bless our reaction to it (i.e., accept



that first reaction as a valid starting place)? Can we cultivate in ourselves that gentle confidence and sense of play and curiosity? Or do we deny it because it feels too unsophisticated or because we haven’t heard that reaction described before (i.e., are we uncomfortable with originality?)

In writing, as in science, there’s a lot of value in just honestly *stating the problem*. If a story isn’t going well and I honestly state the problem as, “This story gets boring right around page three”—well, suddenly the fix is fairly obvious (“Make it less boring on page three”). But it’s easy to get stuck in that very unscientific state, denial.

Engineering and writing also share the invaluable idea of iteration.

Some writers have this mystical

idea that the story comes to them all at once, while they are in a state of inspiration. I’ve never had that experience. When I’m writing a story, I’m going through the thing hundreds or thousands of times, micro-adjusting to taste, trusting that this iterative application of my preferences (my attempts to be more truthful, really) will gradually move the story to higher ground. So, the focus is not on some Big Truth at which I’ve already arrived, which I’m trying to perfectly convey or prove—I don’t know what truth I’m wandering toward. I’m just trying to be truthful in every little moment. And this feels scientific to me, this sense of continually asking, “Huh, I wonder what might be true?” and “How might I most honor truth at this point in the process?”

MM: Why is fiction still important today?

Saunders: Fiction can, arguably, help us become more empathetic—it opens us up to the idea that other people might be as real as we are after all. It does this by locating us into the head of another person for a dozen pages or so—we become that person temporarily, and, being them (surprise, surprise) we come to love them a little bit. (Another thing the world might benefit from these days.) In a sense, that’s what love is—the willingness to pay attention to another person, on the assumption that you are her and she is you, if only we can see deeply enough.

▶ *This conversation has been abridged. Read the full interview online at minesmagazine.com.

▶ At the end of March, alumni participated in the annual Blaster’s Basket Drive, donating nonperishables, puzzles, games and more to help students in need—especially those in quarantine—across the Mines campus. •



Thank you



Orediggers share a unique connection with Mines. President's Council members embody that connection. The council's ongoing dedication and loyalty continues to ensure the future of Mines and enables endless possibilities for Orediggers.

Julie '86 and Scott '85 King
President's Council Co-Chairs

This spring marks the President's Council's 35th anniversary. Today, we approach nearly 1,000 annual members who invest in Mines' students and programs with gifts of \$1,000 or more. Despite many changes at Mines and throughout the world, your steadfast generosity has remained a touchstone for nearly four decades.

Mines is honored by your unwavering support – establishing scholarships to attract the best students from all backgrounds, fueling groundbreaking research and creating an immersive student experience.



**THE PRESIDENT'S
COUNCIL**



NEW METHODS, SAME RIGOR

Graduate programs are becoming more flexible to accommodate the busy working professional

BY MARK RAMIREZ

Over the past century and a half, even as Mines has built a reputation for stellar science and engineering research, the university has always placed great importance on preparing its students for successful careers in industry.

That focus continues to this day, as Mines adapts to an ever-evolving social and employment landscape by expanding its postgraduate offerings, taking advantage of the latest technology and shaping programs to make them more flexible and “stackable.”

Until 1966, the university had offered its students professional degrees, which required 170 credit hours of coursework. While the programs provided a high-quality education, by then, few of the companies that hired Mines graduates distinguished between those and bachelor of science programs, which required as few as 130 credit hours at other institutions. Ultimately, Mines decided to offer bachelor's degrees while awarding the professional degree as a second, graduate degree for those who put in the additional work.

Today, Mines' commitment to improving its students' career prospects is reflected in the



university's growing catalog of postgraduate offerings, said John Bradford, professor of geophysics and vice president for global initiatives.

For example, in addition to the traditional 30-credit master's programs that require 6 to 12 credit hours of research, more departments are offering non-thesis master's programs to give students—often working professionals—more opportunities to gain advanced training or an additional skill set. “It is really difficult to complete a research-based degree,” Bradford said. “It requires large blocks of time, whereas coursework can be split into smaller chunks. It doesn't necessarily take less time, but it's more flexible.”

Mines is also offering more graduate certificate programs, many of which can be completed partly or fully online. “It's the same target audience—people who are working, bachelor's degree holders looking to build their skill set with less time

commitment,” Bradford said. “It's more viable for people who are busy or starting a family.”

Plus, some of these certificates can be “stacked.” Mines' graduate certificate in business analytics, for example, can be combined with two others in the works—product management and entrepreneurship—and just one additional course to complete a master's degree from the Division of Economics and Business.

Expanding non-degree offerings—short courses or boot camps that run for a week or less—is another focus for the university, Bradford said, creating a continuum of educational offerings in response to rising demand.

“All of these programs that we're working on, whether online or in person, we're making sure everyone still gets the Mines experience,” Bradford said. “They will be rigorous, hone students' ability to do hard work, as well as gain a practical understanding of how things need to work in the real world.”

- ▶ Alumni were invited to a webinar hosted by the Mines Global Energy Future Initiative and Payne Institute on April 7 to hear from Eamon Ryan, Ireland's minister for the environment, climate and communications and minister for transport, about the country's climate change strategy. •

MAKING ROOM AT THE TABLE

Good leadership and bold innovation start with inclusion

BY ASHLEY SPURGEON

Being a professional leader takes more than business acumen and a stroke of luck. It often requires the ability to build a supportive company culture and the audacity to pursue new ideas from those with different experiences.

As CEO and co-founder of the National Center for Women & Information Technology, Lucy Sanders knows this firsthand. We talked with Sanders about cultivating values and supporting inclusion in the workplace and how to learn from professional failures.

Much of your career has focused on a commitment to innovative technology, and your current role focuses on supporting underrepresented communities in computing. Why are these areas an emphasis for you?

Lucy Sanders: I first started working on underrepresentation in computing while at AT&T Bell Labs as an R&D lead. At that time, my organization partnered with Colorado School of Mines on a program to assure Indigenous students had pathways into engineering, science and math. Over the years, I became broadly interested in the path of all those who are underrepresented in computing and engineering. What can we do, either as practitioners or nonprofit leads or researchers, to make sure these disciplines have representation from a broad range of identity groups? They will bring many great ideas and lived experiences that can lead to new discoveries, new products, new services, etc. So as an innovator—which I consider myself to be—the potential really excites me, and I can't wait to see what they bring.

What have been some the challenges you've faced, and what did you learn from them?

Sanders: I've received great mentoring in my life. I've been fortunate to have a number of wonderful allies—people who are supportive of bringing everybody to the technology and engineering design table.

Of course, there are challenges. Whenever you are a member of a minority group in any context, you'll



most likely face cultural challenges. For example, a person who identifies as a female in engineering, an African American in computer science or a person who identifies as male in nursing may find it more challenging since these cultures often have large majority populations. Likewise, whenever you're in the majority group, you have an obligation to create a more inclusive culture for those who are not in the majority.

When I got my computer science degree, there were very few women in the discipline, and the challenges were tough. I had to work harder. I had to grow my own skills. But then again, I have to hand it to Bell Labs—they were also doing hard work to create an inclusive culture and not just putting it on my back to be tougher or better than everybody else.

As we work to create inclusive cultures, we need to focus on removing systemic barriers that make it difficult for members of marginalized groups to

CONNECTIONS

- ▶ Paul Dorr '74 recently began supporting Mines students through scholarship and mentorship through his foundation, Hope's Enduring Flame. •

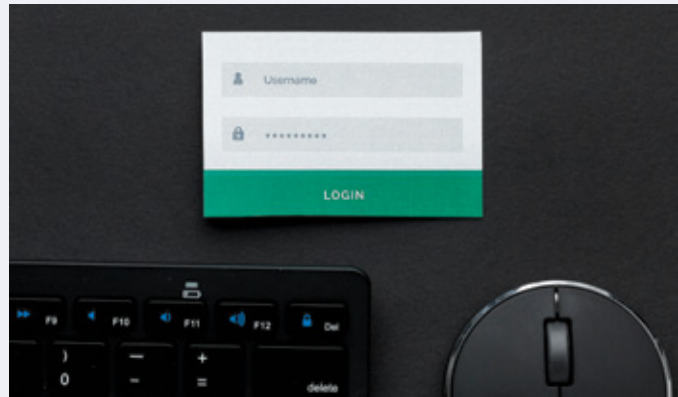
succeed and not on solutions that suggest they have some type of deficit that needs correction before they can fit into a biased system. Of course, everybody benefits from professional development, but professional development should not be confused with making our cultures more inclusive.

Would you say that cultivating those values within a business starts at the system level rather than the personal level?

Sanders: I think it's both. As engineers, we like to say, "Is it this or that?" But it's both. Individuals can do a lot, and in fact, they're very important, because if you think about inclusive cultures—either in a classroom or a company—it's our everyday interactions with students or on a work project team that cause people to feel like they either belong or they don't. However, it's also important for top leadership to really understand what inclusive cultures are and how to work inclusive leadership into their skill sets.

What was a time when you failed, and what did you learn from that failure?

Sanders: To me as an engineer, there was true and there was false. And there was right and there was wrong. And I think that's very normal for engineers, because that's how we're trained to solve problems and come up with the best solutions. The failures I've had have been mostly centered around not recognizing the gray space and not understanding that it's not always that binary. I would sometimes offend people, because I would say, "Well, this is just plain wrong," but I hadn't taken the human perspective into play. What I've learned is, if you want your ideas implemented, you've got to take both the engineering perspective and human perspective and intersect them.



TECH TIP

Protect yourself—and your data—online

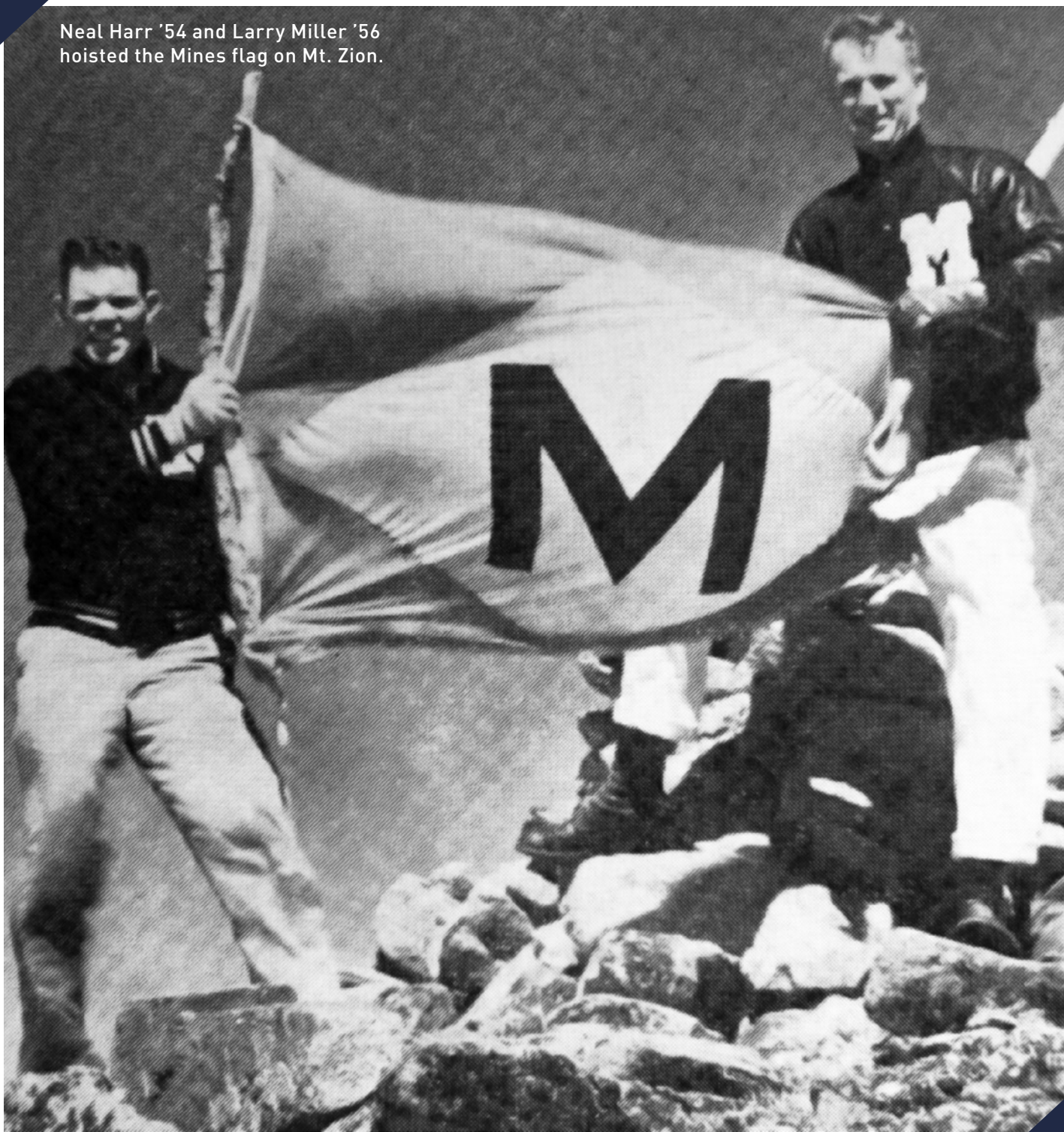
From shopping to banking to working, much of everyday life happens online these days. Unfortunately, that also means there are more opportunities for personal data to be stolen. But by implementing some best practices, you can keep your online transactions and interactions secure. Here are just a few.

1. Use a different random password for every site or account you visit regardless of how important the site is to you, even if it is just the loyalty program at the local pizza place.
2. Never open email from addresses you don't know. If an email you think looks suspicious contains a link or attachment, don't click.
3. Make sure your software is up-to-date. Turn on automatic updates for your web browsers and devices—updates often include critical fixes for security holes.
4. Don't save your financial information on websites you buy from, even if you shop there frequently, in case that company's website or network suffers a data breach. And before purchasing online, make sure the website's URL starts with "https://." The "s" is critical—it indicates your connection is encrypted.
5. Back up your data regularly, and keep them "air-gapped." Either leave your backup disk unplugged anytime you are not actively making a backup or, better yet, use two disks and switch which one is connected once a week.

▶ Have a useful tech tip you'd like to share, or want to know more about an everyday technology? Let us know at minesmagazine.com/contact-us.

▶ 37 alumni and other members of the Mines community gathered for the March lunch bunch event to hear from Scott Houser, undergraduate program director for economics and business at Mines, about what is new in the program. •

Neal Harr '54 and Larry Miller '56
hoisted the Mines flag on Mt. Zion.



We're proud of Mines alumni. We want to cheer you on and celebrate your accomplishments. Tell us about your recent wedding, a new baby or your new job. Share a personal or professional accomplishment, volunteer activity or your favorite Mines memories. Stay connected to the Oredigger family.

▶ Submit a class note at minesmagazine.com/classnote.



NEW ADDITIONS TO MINES' BOARD OF TRUSTEES

Two new members were appointed to Mines' Board of Trustees by Colorado Gov. Jared Polis in January 2021. **Bruce Grewcock '76** and Judith Zee Steinberg will each serve a four-year term through December 2024. Current Trustee **Jesus Salazar '02** was also reappointed to a second four-year term.

For more about the Mines Board of Trustees, go to mines.edu/trustees.

1970s

Rhys Schneider '78 retired after more than 40 years in the oil and gas industry.

1980s

Ron Clayton '80 was announced as a member of the management team for i-80 Gold Corp, serving as chairman of the board, in February 2021.

Carrie Manfrino MS '84 joined the University College of the Cayman Islands as a visiting scholar and research professor, retiring from her post as president and CEO of the Central Caribbean Marine Institute.

Francis Vallejo '87 was appointed to Crestwood Equity Partner's board

of directors as a general partner in February 2021.

Tammy Angel '89 was named the U.S. Forest Service's new acting forester of the Rocky Mountain region

Timothy Hylton '89, PhD '94 was recently promoted to vice president, quality and technical services of EVRAZ, North America, effective February 2020.

1990s

Omar Ahmed Suwaina Al Suwaidi '90 was appointed undersecretary of the United Arab Emirates' Ministry of Industry and Advanced Technology in February 2021.

Julia Gwaltney '93 was appointed the new senior vice president of development of Penn Virginia Corp. in January 2021.

John Kaszuba PhD '97, a professor at the University of Wyoming, was selected as the school's John and Jane Wold Centennial Chair in Energy in December 2020.

Leif Nelson '97 was appointed chief technology officer of Seadrill Limited in December 2020.

Mohan Dangi '99, MS '02 was awarded a Jefferson Science Fellowship to advise U.S. government officials on topics of science that have a bearing on U.S. foreign policy and global dealings, beginning in August 2021.

SHAE QUIGLEY '16 AND VINAY DUDDEMPUDI '16



Kiran Patankar '99 was appointed senior vice president of growth strategy for Maple Gold Mines in March 2021.

2000s

Ezra Jacob MS '02 was promoted to president of EOG Resources in January 2021.

Tamara Maxwell '06 joined Worldsensing in March 2021 as a technical sales specialist.

Emily Hayter '07 joined BBG Law Group as a special projects analyst in December 2020.

2010s

Amar Gujral MS '13 was named a partner at global management consulting firm L.E.K. Consulting in January 2021.

Edward Wolfram '15 and Cassandra Wolfram welcomed Paul Elias Wolfram on Jan. 29, 2021. Paul will

join his sister Esther in one day extending the family tradition of attending Mines like their father and uncles Phillip '08 and Preston Wolfram '11.

Isabel Goñi-McAteer '16 and **Jacob Thomas '16** had a blustery elopement wedding on South Table Mountain in Golden, Colo., on Jan. 16, 2021. The couple met during their first year at Mines in chemistry lab. Their other lab partner, Levi Rawlings '16, organized the couple's first South Table hike eight years ago.

Shae Quigley '16 and **Vinay Duddempudi '16** got married in Vijayawada, India, in January 2020, with celebrations lasting Jan. 28-31. Several Mines alumni attended the wedding, including Alexa Baker '16, Bryan Baker '16, Diane Roher '16, Lauren Parry '16, Melody Clay '15, MS '18, Colin Downs '13, Allison Keator '16, MS '18, Krista Horn '15, Haley Salzwedel '16, Sara Foster '17, Karan Titus '16, Jennifer Tippetts '17 and Arielle Steers '13.

Josh Reed '16 and Elizabeth Reed welcomed a baby girl to their family. Emberly Jordan arrived on Jan. 12, 2021, joining big sister Nova (2).

Despite the COVID-19 pandemic canceling their original wedding plans, **Megan Auger '18** and **Joel Ebers '18** were married on June 27, 2020, atop a mountain in the central Cascades in Washington. While the couple met and became friends during their first year at Mines, they didn't start dating until after both had graduated with degrees in mechanical engineering—reconnecting in Seattle, where Megan is pursuing her doctoral degree at the University of Washington.

John DeDecker PhD '19 was appointed vice president of exploration of Eskay Mining Corp in January 2021.

**ISABEL GOÑI-MCATEER '16
AND JACOB THOMAS '16**



MEGAN AUGER '18 AND JOEL EBERS '18



EMBERLEY REED

PAUL WOLFRAM



REMEMBERING MICHAEL LEE '14 (1992-2020)



A few superstars have teed off for Mines' golf team, winning numerous titles and awards, while showing equally impressive academic skills in the classroom and beyond. But few were as impressive as **Michael Lee '14**.

During his time at Mines, Lee excelled on the golf course, becoming an All-American, four-time Ping All-Region honoree and a two-time RMAC Player of the Year. The two-year Oredigger captain not only won the Golfweek Division II Preview in 2012 but became the top-ranked Division II golfer in the U.S. in 2013 with an average score of 70.8. However, Lee's biggest victory

as an amateur golfer was at the 2011 CGA Match Play where he rallied to defeat former CGA Amateur champion Jonathan Marsico in the 36-hole final at Bear Creek Golf Club to become the 11th Colorado Golf Association Match Play Champion.

Off the golf course, Lee showed equally impressive skill as an engineer. Graduating with a bachelor's degree in petroleum engineering from Mines in 2014, Lee was awarded the President's Senior Scholar Athlete Award and went on to work for Anadarko Petroleum as a production engineer. Considered a rising star in the industry, Lee's work covered multiple disciplines and was part of the company's mentor recruiting program.

Although Lee died in December 2020 due to complications from COVID-19, the impressive example he set on the golf course, in the classroom and beyond will endure. Lee's family set up the Michael Lee '14 Memorial Scholarship in his honor to support future members of the Oredigger men's golf team and provide the opportunity for others to pursue their dreams both on the golf course and as future engineers.

▶ Contribute to the Michael Lee '14 Memorial Scholarship at weare.mines.edu/michaellescholarship.



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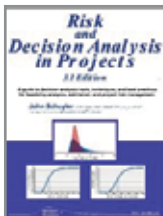
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IN MEMORIAM

Remembering Orediggers who have passed away but will always remain part of the Mines community

H. Don Adams '52 died Jan. 2, 2021.

Born in 1929, Don played for the Oredigger football team as a Mines student. He served as a combat engineer in the U.S. Army before building a career working for Sinclair and Amoco. Don eventually started his own business and served as president of the Mines Alumni Association.

Lynn A. Brown '50, DS '70 died Aug. 6, 2020. Born in 1927, Lynn first attended Mines after serving in the U.S. Navy. He worked as a geological engineer on dams and tunnels on five continents and most of the Western United States. He taught at Purdue University for eight years and finished his career at the U.S. Bureau of Reclamation.

Donald M. Gerwin '64 died Dec. 20, 2020. Don was a member of the Sigma Alpha Epsilon fraternity and ROTC as a Mines student. He served in the U.S. Army mapping islands in the South Pacific before starting his career as a geophysicist with Mobil Oil and ARCO in Alaska exploration, and for the State of Alaska Oil and Gas Accounting Group. He retired in 2000.

John O. Golden died Nov. 14, 2020. John spent most of his career at Mines, beginning in 1967, serving as a professor, director of research services, graduate dean and vice president of academic affairs. John and his wife, Lynne, also taught in the EPICS program. He later served as chief academic officer of the Petroleum Institute in Abu Dhabi. In 2006, John and Lynne both received Mines' George R. Brown Medal—one of Mines' rarest and most prestigious honors—in recognition of their distinguished service in or to the field of engineering education.

John D. Haun died Aug. 8, 2020.

Born in 1921, John joined the Mines faculty in 1955, teaching subjects

such as petroleum geology and field geology. He left Mines in 1980 and received emeritus status in 1983. John established the Barlow and Haun, Inc. Scholarship—now known as the John and Lois Haun Scholarship—at Mines in 1979 to support students in petroleum geology.

Frank Mathews died in January 2021. Frank taught as a physics professor at Mines from 1954 to 1986 and helped found Golden's Solar Energy Research Institute. In the summers, he served as a consultant to the U.S. Navy and participated in USAID alternative energy projects around the world.

Paul L. Person '71 died Nov. 19, 2020. Born in 1944, Paul worked for several mining companies and processing equipment firms throughout his career and specialized in comminution, flotation and gravity separation applications at the major base and precious metal mines.

Roger J. Phillips '63 died Nov. 19, 2020. Roger was a member of Sigma Phi Epsilon and earned three varsity letters in football as a Mines student. In his career, Roger made major contributions to understanding the interior structures of other planets, including work as team leader for the Apollo Lunar Sounder experiment, which flew on Apollo 17, and co-leader for the shallow

radar experiment on the Mars Reconnaissance Orbiter.

John R. "Jack" Weyler '50 died Dec. 25, 2020. Born in 1924, Jack served in World War II before attending Mines. He played centerfield for the Oredigger baseball team and was honored by the school for his contribution to the recent upgrade of the baseball field complex. Jack spent 60 years working in the petroleum industry.

Kathleen Margaret Wiltsey '77 died Feb. 2, 2021. Kathy spent her career as a biotechnology company executive and was instrumental in bringing life-changing drugs to market. When she later moved on to the nonprofit sector, much of her work involved promoting science and mathematics. In 1989, the Wall Street Journal named Kathy one of that year's 25 people to watch in business, and Kathy received Mines' Distinguished Achievement Medal in 2003.

► To submit an obituary for publication in Mines Magazine, visit minesmagazine.com/obituary.

Memorial gifts to the Colorado School of Mines Foundation are a meaningful way to honor the legacy of friends and colleagues while communicating your support to survivors. For more information, call **303-273-3275** or visit weare.mines.edu/givingguide.







BACK AND BETTER THAN EVER

The Mines Museum reopens—with renovations and new exhibits on display

The Mines Museum of Earth Science—formerly known as the Mines Geology Museum—may have been closed for almost a year due to the COVID-19 pandemic, but a lot was still happening behind the scenes to ensure there would be plenty for visitors to see when it finally reopened to the public in February 2021.

“We’re excited to finally reopen the doors of the museum to the public—with a completely renovated entrance, new exhibits and, yes, new protocols in place,” museum director Renata Lafler said. “We’ve been busy over the past year improving the museum experience for our guests—and that includes officially launching our new name, the Mines Museum of Earth Science, to better reflect our mission and one-of-a-kind collections dedicated to the earth sciences and Colorado’s mineral heritage.”

Among the most noticeable changes to the museum:

- A brand-new museum store located at the museum’s entrance and a new welcome desk with an amethyst countertop
- A new collection of mining artifacts donated by the family of Mines alumnus Frederick R. Dowsett Jr. ’69
- Expanded exhibits of Colorado minerals, including a new section dedicated to minerals from the Sweet Home Mine in Alma
- New interactive activities for kids, including Find Blaster to win prizes

Also newly on display is a meteorite that was found in Colorado and weighs over 40 pounds. The donor used the mass of H6 ordinary chondrite as a doorstep until its true nature was discovered—he found it in 1941 in a field that belonged to his family.

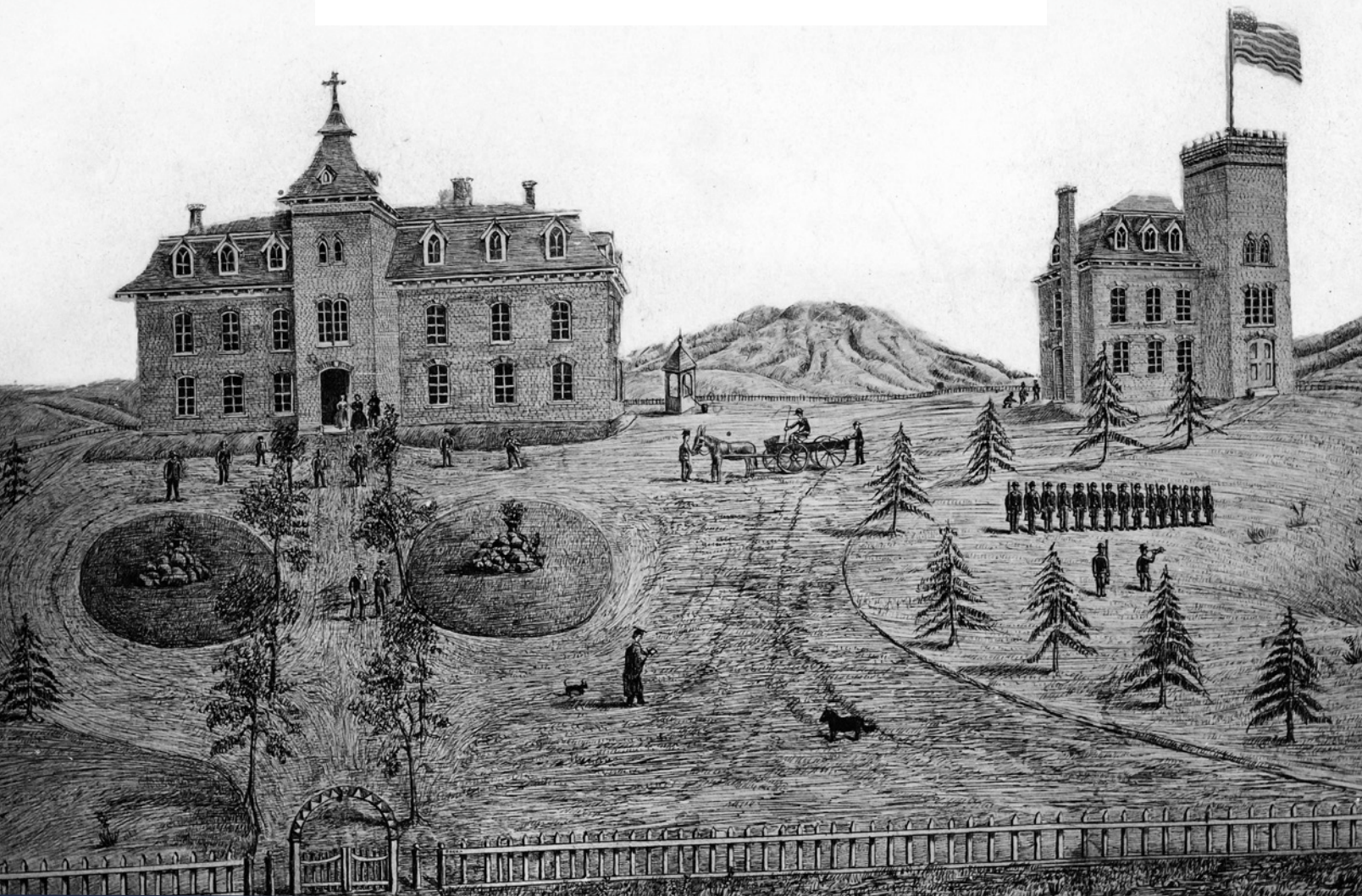
- ▶ For more information about the Mines Museum, including safety protocols and reservations, visit mines.edu/museumofearthscience.





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Mines may have started out with three buildings back in 1874—with Jarvis Hall pictured here on the left, the mining school on the left and Matthews Hall (not shown) to the left of Jarvis Hall—but the campus has grown significantly over its nearly 150-year history to accommodate student needs, provide top-notch research facilities and help solve some of the world's most pressing engineering and scientific challenges. Today, Mines' newest additions to campus are aimed at meeting those same goals, with an emphasis on supporting entrepreneurship and innovation education to prepare students for entering the workforce while giving them the tools and skills they need to succeed beyond their journey at Mines.

▶ Follow along at mines.edu/mines-at-150.

