

MINES MAGAZINE

COLORADO SCHOOL OF MINES ALUMNI MAGAZINE

Summer 2017 Volume 108 Number 3

FROM STEM TO STEAM 14

While science and art are often seen as separate fields, many Mines students are integrating creative pursuits into their STEM educations, showing that science and art are inextricably linked.

CATCHING CODE 20

Seeing significant growth in computer science education across the country and the need for qualified professionals with computing skills, Mines' computer science program is rising to meet the demand.

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Mines engineers and scientists blend technical skills with the arts to facilitate innovation.

CATCHING CODE

20

High job satisfaction and an increase in career opportunities is attracting more students to computer science programs across the country.

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WEB EXTRAS | MULTIMEDIA

TO VIEW WEB EXTRAS, PLEASE VISIT MINESMAGAZINE.COM

E-DAYS

From the cardboard boat race to the ore-cart pull, Orediggers gathered this April to celebrate another successful year at Mines. Check out our photo spread of this year's E-Days festivities on page 12-13, and then visit our website to see more.

OREDIGGER HEADLINES

For our "Looking Back" story in this issue, we investigated the history of Mines' student newspaper, *The Oredigger*, to see the issues it has covered and how the tradition has carried through to today. Visit *Mines Magazine's* website to read some of our favorite headlines over the years and to get a taste of the issues that were important to Mines students over the years.

THIS WEEK AT MINES

Mines has started a new podcast, called "This Week at Mines." The podcast aims to highlight some of the major events happening on campus each week and includes student and alumni interviews. Follow "This Week at Mines" on Facebook to stay up-to-date with all that is happening on campus, and check out the latest episode for our special alumni edition and to find out all that you need to know about Homecoming 2017.

KEEP TABS ON MINES' PRESIDENT

Stay up-to-date with everything President Johnson is up to and gain insight into his thoughts about what is happening at Mines. Follow him on Twitter by searching for the handle [@ILoveBlaster](https://twitter.com/ILoveBlaster) for all the latest from Mines' president.





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 Paul C. Johnson

President, Board of Directors

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Assistant Editor, *Mines Magazine*

Colorado School of Mines
 Ashley Spurgeon

Editorial Board

Stu Bennett '66, Damian Friend '75, Peter Han, Lisa Kinzel, Larry Preble '61, John Spear MS '94 PhD '99, Rachele Trujillo

Contributing Writers

Agata Bogucka, Joe DelNero, Tim Flynn, Teresa Meek, Mark Ramirez, Lisa Shumate, Anica Wong

Advertising Contact

Ashley Spurgeon
aspurgeon@mines.edu
 303-273-3959

Graphic Design

FlowState Marketing

Mines Magazine is published by Colorado School of Mines and the Mines Alumni Association for alumni and friends of the school. *Mines Magazine* is a critical communication serving the Colorado School of Mines community. Its mission is to keep readers informed about the school, to further the goals of the school and the alumni association and to foster connectedness.

Comments and suggestions are welcome. Contact us via our contact form at mines-magazine.com/contact-us/ or via mail at Mines Magazine, PO Box 1410, Golden, CO 80402. To update your address, go to minesalumni.com/update or email CSMAA@mines.edu.

ALUMNI NOTE

AN OREDIGGER'S TRUTH

Throughout my career, certain truths have formed the foundation of how I work and live my life. I came to see the value in my relationships and the opportunities I've had, the importance of effective communication, the influence of knowledge and the benefits of being in service to others. I see these principles everywhere at Colorado School of Mines, and I feel they bring value to the alumni community.

The relationships we cultivate are necessary for enhancing our own lives and positively affecting those around us. Think of the important relationships in your life: your family, close friends and professional colleagues. These relationships have a tremendous impact on the person you become. As executive director of the Mines Alumni Association, I work daily to cultivate relationships that will enhance the Mines community, and I encourage you to do the same.

These relationships will likely lead to new opportunities, some of which may be more influential than others. In my position at Mines, I see opportunities to bring individuals together through common interests, both among alumni and across the university. It is through these shared interests that people are more likely to get involved in what they feel is important and worthwhile. As you look at future opportunities that come to you as a Mines graduate, I encourage you to make a meaningful impact, whether by mentoring students or volunteering on campus or in your local alumni groups.

Yet the key to building meaningful relationships and being open to new opportunities is communication. You can imagine, with 29,000 alumni, that communication is at the heart of the Alumni Association's focus. We strive to be a conduit of impactful and pertinent information between the university and alumni through our interest groups, *Mines Magazine*, emails and more. Our interest groups in particular work as communication hubs and get alumni involved in specialized areas where the most valuable information can be shared and the biggest impact made. For more information on our interest groups, see pages 26-27 or visit minesalumni.com.

Of course, what brings us all together at Mines is a desire for knowledge. We all have a commitment to learning about our world and how we interact with our earth, energy and environment. There are many opportunities for you to share your knowledge through engagement between students and alumni as well as speaking and teaching opportunities. Mines students and alumni are always eager to hear about others' experiences, which creates a strong community.

Finally, a quality I've noticed many Orediggers share is a commitment to service. Recently, nearly 500 students participated in the second annual Helluva Service Event, serving the needs of the Golden community in thanks for their support of Mines. It was a great demonstration of the Mines spirit, and I urge you to continue to search for ways to serve your community and Mines. By serving others, we gain so much in return.

I am honored to serve such a successful and impactful group of Mines alumni. Please let us know how the Alumni Association may work to fulfill your own values. Thank you for your continued support of the Alumni Association and the university!



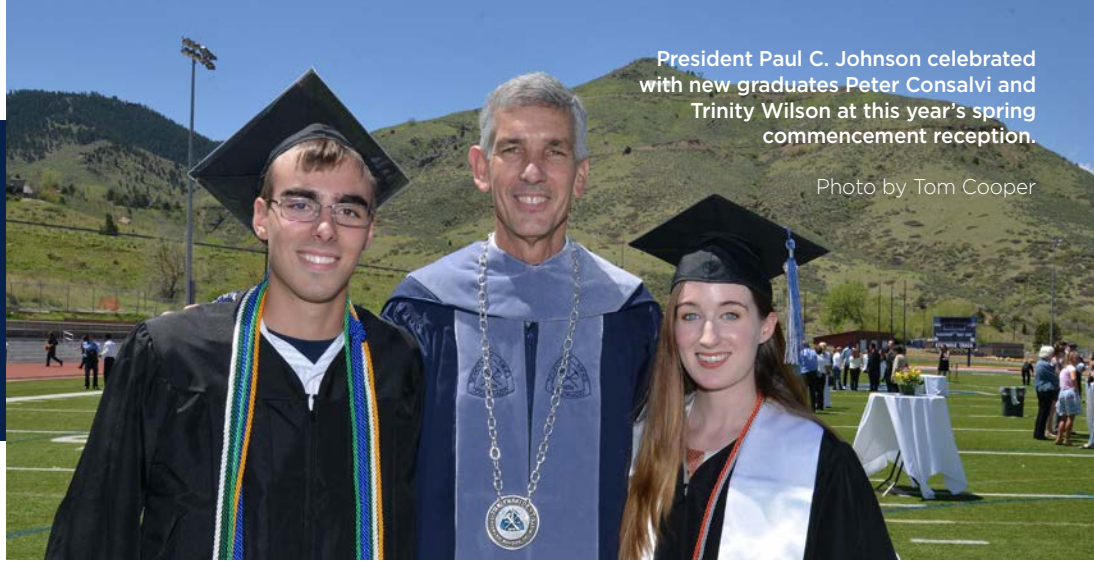
DAMIAN FRIEND, P.G.
 BS Geological Engineering
 Executive Director, Mines
 Alumni Association

President Paul C. Johnson celebrated with new graduates Peter Consalvi and Trinity Wilson at this year's spring commencement reception.

Photo by Tom Cooper

PRESIDENT'S CORNER

THREE QUESTIONS WITH PRESIDENT JOHNSON



#1

What advice do you have for new Mines graduates?

Be confident that you are prepared for the real world. The skills and personal characteristics that led to your success at Mines—team work, hard work, creativity, leadership, persistence and resilience—are the same ones that will set you apart and set you up for success in your professional and personal lives. You are a Mines alumna/alumnus—you can tackle anything!

#2

What does being a Mines alumnus mean to you and how are alumni an important part of the Mines community?

Having a Mines degree says a lot about an individual, and it instantly commands respect. Being an alumnus also carries an obligation to give back in some way to ensure that Mines sustains its position as one of the world's premier universities. Our alumni are our secret weapon and are critical to the future success of Mines. They serve as ambassadors and recruiters for Mines, they generously support our amazing students and unique programs, and they are engaged as teachers, advisors and mentors for the next generation of Orediggers. The Mines Alumni Association works closely with us to connect alumni to our classrooms, student groups and strategic initiatives, like entrepreneurship and innovation, professional development, continuing education, mentoring and recruiting a more diverse population of students.

#3

What is your favorite part of a big alumni event, such as Homecoming?

Spending time with alumni and hearing their stories. Most are hilarious, some are scary and hopefully the statute of limitations has run out on others. Recently I learned about fireworks shows from the past, dynamite in the clay pits and a few other interesting lost E-Days traditions. What I like most about the stories is that you can feel the pride the storytellers have in being an Oredigger and the love they have for Mines and their fellow alumni. That pride is so infectious and inspiring. It makes me realize what a special place Mines is and what an honor it is to be a part of the Mines community. I hope that we can create a video library of alumni stories, although we may have to blur the faces and change the voices on some of them.

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Mines researchers put together a space observatory for NASA, in collaboration with partners from around the world, launching a balloon to measure cosmic rays entering the Earth's atmosphere.

Photo courtesy of Lawrence Wiencke



STUDYING COSMIC RAYS

MINES-BUILT SPACE OBSERVATORY LAUNCHED INTO THE STRATOSPHERE

A NASA space observatory put together by Colorado School of Mines researchers launched from Wanaka Airport in Otago, New Zealand, the afternoon of April 24, 2017, in a pioneering attempt to observe ultra-high-energy cosmic rays entering Earth's atmosphere.

The Extreme Universe Space Observatory Super Pressure Balloon flew at 110,000 feet, and was designed to travel for up to 100 days. Researchers hoped to gain insight into the origins of the highest-energy subatomic particles known to exist in the universe, and how they traveled to Earth.

Mines Physics Professor Lawrence Wiencke, co-project leader, oversaw a team of students and faculty in assembling the gondola, as well as integrating the instrumentation to allow the transmission of data. The observatory underwent testing at NASA's scientific balloon facility in Palestine, Texas, last November and was shipped to New Zealand in December. The observatory passed its final tests March 23.

"Amazing," Wiencke said about the successful launch. "The 1,000-foot flight train was released smoothly from the 'pin' on the end of the launch crane and the entire 10,000 pounds of balloon, parachute and EUSO-SPB payload rose nearly straight up." The balloon reached 109,000 feet about three hours after launch—a critical milestone. The observation of these cosmic rays is a challenge because of their rarity. At the highest energies, which are well beyond the capabilities of man-made particle accelerators, fewer than one cosmic ray enters Earth's atmosphere per square kilometer per century.

"High-energy cosmic rays have never been observed this way from space, and space offers the biggest view of the atmosphere," Wiencke said. "This is a pioneering opportunity for us," he added.

"We know that these extremely energetic particles travel from faraway galaxies to reach the Earth," said Angela Olinto, principal investigator

and professor at the University of Chicago. "We need to observe a significantly larger number of these cosmic messengers to discover what their sources are and how particles interact at these energetic extremes."

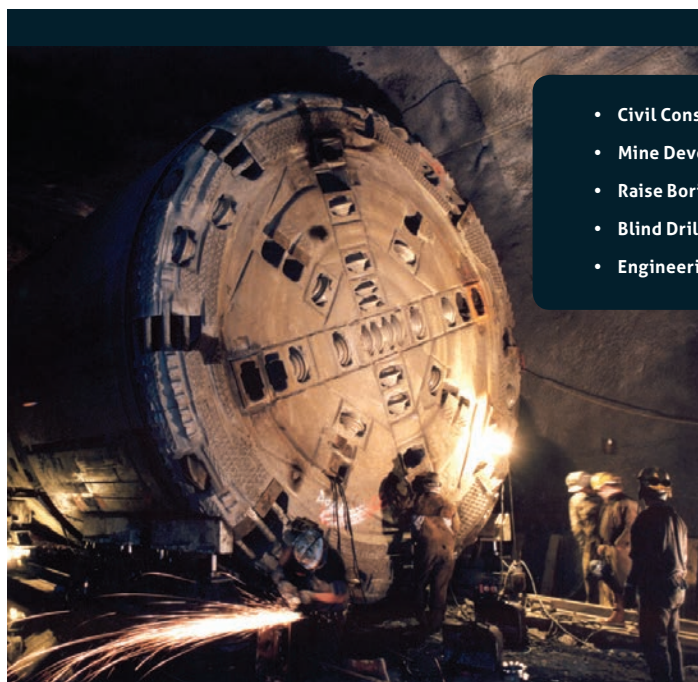
When such a cosmic ray reaches Earth, the interaction with nitrogen molecules in the atmosphere creates fluorescent light proportional to the energy of the particle.

Instrument subsystems were shipped to Mines, where the detector was assembled and tested. Mines team members Adjunct Professor William Finch and machine shop head Randy Bachman, working with counterparts at NASA, designed a mechanical exoskeleton structure. Undergraduate engineering physics students Rachel Gregg and Zach Polonsky performed much of the fabrication.

The Mines group led optics testing and successful field tests using lasers in the Utah. Wiencke, postdoctoral researcher Simon Bacholle, PhD student Johannes Eser and Gregg traveled to the Wanaka launch site in February to prepare the instrument for launch along with other members of the international collaboration. Eser was responsible for instrument operations during launch, while Gregg was in charge of critical steps on the launch day checklist. Bacholle returned to Mines and set up a remote operation center, while former Mines postdoc Lech Piotrowski was responsible for the remote operations center at the RIKEN institute near Tokyo.

Despite the successful launch, a leak in the balloon and a poor weather forecast prompted NASA to preemptively end the flight to ensure the greatest level of control and safety during the balloon's descent. Yet, the balloon was still able to collect a great amount of data, and researchers will apply the lessons learned from this flight to future flights as they continue to develop this technology.

By **Mark Ramirez**



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ATHLETICS

OREDIGGERS BRING MARCH MADNESS TO GOLDEN

Ben Sonnefeld drives to the lane in the NCAA Elite Eight against Bellarmine at the Sanford Pentagon in Sioux Falls, S.D.

Photo by Inertia Photography

With about a minute and a half left in the Rocky Mountain Athletic Conference Men's Basketball Tournament championship game, it certainly looked like Colorado School of Mines' dream of a storybook ending wasn't going to happen.

Two weeks earlier, Mines had won in overtime on the road against their biggest rival, Fort Lewis College. But this time, it seemed all but certain things would be reversed. With 1:22 left on the clock, the Orediggers trailed the Skyhawks by eight points. If you listened to the statistics, Mines had a 99.3 percent chance of losing. They didn't.

Somehow—in one of those “if you didn't see it, you wouldn't believe it” endings—the game was tied when the clock hit zero, thanks to two free throws by junior center Ben Clare. After junior guard Luke Schroepfer scored 10 of his 24 points in overtime, Mines walked off its home court with a 102-98 win. “I can't even remember it. There were a lot of things that had to

happen for us to win, and they all did,” said head coach Pryor Orser. “Of all the wins we've had, that's one of the biggest. [It] enabled us to host the NCAA regional tournament. If we hadn't won that game, we'd be going on the road to Texas-Permian Basin.”

As it turned out, that 1:22 set the tone for the rest of the season. Mines went on to host the first three rounds of NCAA Championship play, winning the South Central regional trophy for the first time. They dominated their regional competition to the delight of deafening crowds at Lockridge Arena. Mines then defeated University of Arkansas-Fort Smith, 90-79, in the first round of the tournament before a stunning blowout of Fort Lewis, 86-67, in the second round to advance to the Sweet 16. The Orediggers went up big early against their regional final opponent, West Texas A&M University, and won 88-63, earning the team their first-ever trip to the NCAA Elite Eight in Sioux Falls, South Dakota.

That two-week span in March is something few Oredigger fans will forget. Packed houses greeted Mines at each game, with the team winning six games in a row at home. "It's really uplifting to see all these people come to support you. There's no feeling like it," said Clare.

"I can't even remember it. There were a lot of things that had to happen for us to win, and they all did."

- Coach Pryor Orser

As the coaches and student-athletes soon realized, their trip to South Dakota was not for any old basketball game. The team received red-carpet treatment at the host venue, the Sanford Pentagon, and was welcomed with open arms by the Sioux Falls community as they ran drills and talked about goal setting at a local elementary school. They were also interviewed by the local media and greeted by U.S. Senator John Thune and Sioux Falls Mayor Mike Huether at a kickoff banquet.

"It was so surreal," Orser said. "For us coaches, we're in la-la land. We're trying to prep for the next game, and you almost forget about the prestige of going to the Elite Eight and what it's all about."

While the end result—a loss to national power Bellarmine University in the national quarterfinals—wasn't what the Orediggers wanted, the experience was one they'll never forget. Mines ended up advancing farther than any other basketball team in Mines' history, and reaching the Elite Eight is something only two other Mines athletic programs—men's and women's soccer—can say they've done.

"It's the first time our team has been this far. I love the guys on this team," Schroepfer said. "There's not much to say except that it was really fun and awesome. I wouldn't give it up for the world."

By **Tim Flynn**

Mines celebrates winning the RMAC Tournament championship after a heart-stopping 102-98 overtime win against Fort Lewis.

Photo by Tim Flynn

All-American Gokul Natesan blocks a shot in the NCAA South Central Regional Final against West Texas A&M.

Photo by Kris Parker



REACHING NEW HEIGHTS

HUMANITARIAN ENGINEERING EXPANDS TO INCLUDE A NEW MINOR

The Humanitarian Engineering Program at Mines is evolving. Having originated as a minor offered through the Division of Liberal Arts and International Studies (now the Division of Humanities, Arts, and Social Sciences), the program has moved into the College of Engineering and Computational Sciences (CECS) and grown to encompass two minors: the original Humanitarian Engineering (HE) and the new Leadership for Social Responsibility (LSR) minor.

The LSR minor aims to serve students passionate about working for the well-being of communities from within corporate environments. HE and LSR will also be two focus areas in the revised Bachelor of Science in Engineering (BSE) program.

“We are very excited to have a revised BSE among Mines’ program offerings, with HE and LSR in it, so that Mines can become the destination of choice for students seeking to serve society through engineering,” said Humanitarian Engineering Program Director Juan Lucena, professor in the Engineering, Design and Society Division.

The mission of Humanitarian Engineering at Mines is to teach students how engineering can contribute to creating just and sustainable solutions for communities. The program also offers several enrichment opportunities for Mines students, such as the Peace Corps Prep Program, the Shultz Family Fund Lecture Series and scholarships, as well as ongoing relationships with groups across campus committed to bettering the world through engineering.



Mines’ Humanitarian Engineering Program has grown to encompass two minors: one in Humanitarian Engineering and one in Leadership in Social Responsibility. The program also offers several enrichment opportunities such as the Shultz Family Fund Lecture Series, the 2016-2017 Shultz Scholars pictured here.

Photo by Agata Bogucka

“Humanitarian Engineering is an amazing program,” said CECS Dean Kevin Moore. “It was one of the reasons I moved to Mines in 2005, and although I didn’t get involved in promoting and helping build it until 2011, HE’s goals inspire me as both an educator and as an engineer.”

Lucena noted the increased engagement the Shultz Family Fund has brought to the program, saying it “has allowed us to bring HE and LSR to new faculty, student and professional audiences, to engage new programs and departments on campus and to explore new opportunities for students beyond the minor.”

He is working to increase engagement, particularly with programs in the geosciences, sparked by growing faculty and student interest in organizations like Geoscientists Without Borders and alumni participation in organizations like Geology in the Public Interest. A new Leadership in Social Responsibility interest group sponsored by the Mines Alumni Association seeks to connect Mines community members who work around issues focused on social responsibility and humanitarian engagement.

Eventually, program leaders hope to make humanitarian engineering at Mines the first bachelor's degree program in the country.

By Agata Bogucka



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"Nothing but a Glance"
by Laura Leonard
(medium: photography)

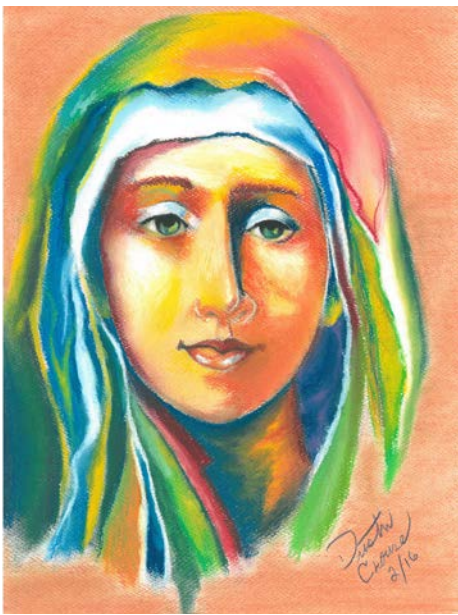


HIGH GRADE

Engineers and scientists are constantly asked to find creative solutions to many problems and make improvements on systems we use every day. This creativity often extends beyond the technical, manifesting in more artistic mediums. Published each spring, Mines' literary arts journal, *High Grade*, showcases the creative talents of Mines students, faculty, staff and alumni and features original art, poetry, fiction, photography and music. Selected by *High Grade's* editors, these are some of the works featured in this year's publication that they felt best represented the journal and Mines' aptitude for the arts.

To view all pieces published in the latest issue of *High Grade* and for additional online content, visit highgrade.mines.edu.

"Theotokos" by Dustin R. Crouse (medium: pastel)



EXCERPT FROM "THE WORLD WITHIN"

by Matthew Kowalsky (short story)

"It is dusk in Florence, and a man standing on the Ponte Vecchio Bridge wonders how it manages to remain unbroken by the world through so many ages. Through tragedy and triumph. Through wind that howls and rain that bites. Through footfalls of conquering kings and gawping tourists alike. It is a marvel that the bridge remains steady beneath the weight of gazes that seek to outnumber the stars. He looks down at a picture, memorizing the contours of a face that he once knew in exquisite detail. He looks harder, longer, hating his memory for slowly obscuring the face of his twin sister. She is looking into the camera. She is in Sienna, in the Piazza del Campo, but is not smiling. Her eyes are like portals, drawing him in. A familiar sense of dread washes over him— her eyes, eternally frozen in time, lead into a place so unknown that he cannot even see its outlines. A place from which she has not returned."

Police Officer Shoots Jaywalker Dead

By KATIE HISLOP
(poem)

An intoxicated homeless man is taken in for fingerprints and drug tests after walking down the median of a busy highway. Upon pulling a switchblade on officers and others, he flees the station and is shot by an officer after refusing to remove his knife from the throat of a pedestrian who'd offered him lunch money (Investigators have yet to identify the victim, citing lack of personal ID, family, work history, and public concern).



"Grit" by Julia Cormos (medium: photography)

PREHISTORE-DAYS



Every spring, Orediggers take a break from their studies to celebrate Engineers' Days as one last hurrah before the end of another school year. This year's theme, "PreHistorE-Days," took Mines back in time, which meant students dressing up in dinosaur costumes or constructing a cardboard boat to look like a vehicle from *The Flintstones*.

This year's celebrations maintained traditions that all Mines students—past and present—share and tested each engineer's innovative prowess, whether it be determining the structural soundness of a cardboard boat against the bitter cold waters of Clear Creek or seeing just how far an object can fly when launched from a student-built trebuchet. Other E-Days activities included the annual ore cart pull to downtown Denver, a concert, field day and, of course, fireworks. Alumni were even encouraged to join the festivities with celebrations and get-togethers as part of their local M Clubs across the U.S. and around the world. No matter where they were, Orediggers spent the weekend taking part in activities that allowed them to blow off some steam, celebrate being an engineer and embrace the Mines community.



FROM STEM TO STEAM

A heightened focus on the arts
is breeding a new generation of
renaissance scientists

by **Lisa Shumate**

After retiring, Evan Anderman MS '93, PhD '96 pursued photography full-time, using his geological engineering background to find the best landscape shots from above. This image is of Powder River Basin, Wyoming.

Photo by Evan Anderman MS '93, PhD '96

MINES ARTS OFFERINGS AT A GLANCE

BALLROOM DANCE CLUB

The fifteen-year-old club provides beginner lessons, social dances, performances and teams for dance competitions and fun. Offerings include tango, waltz and swing. For more information, email minesballroom@gmail.com or find the club on Facebook.

CREATIVE ARTS CLUB

Started in 2004, the club offers open art sessions all year as a creative space for anyone to express their artistic talents. The club provides visual art materials. More information can be found on Facebook.

MINES CREATIVE WRITING CLUB

The club is a student-run group which hosts frequent gatherings and literature-related guest speakers. For more information, email begtvedt@mines.edu.

FILMMAKERS AT MINES

Founded in Spring 2017 to provide students with the means to make creative film content, the club makes creative short films, covering all genres, and provides videography services for various events on campus. Find the club's most recent projects on YouTube, Facebook, Instagram or Twitter.

HIGH GRADE JOURNAL OF THE ARTS

Founded in 1976, *High Grade* is Mines' annual art and literary journal, featuring all genres of original fiction, poetry, photography, art and music from students, faculty, staff and alumni. View the publication online at highgrade.mines.edu.

IMPROV CLUB

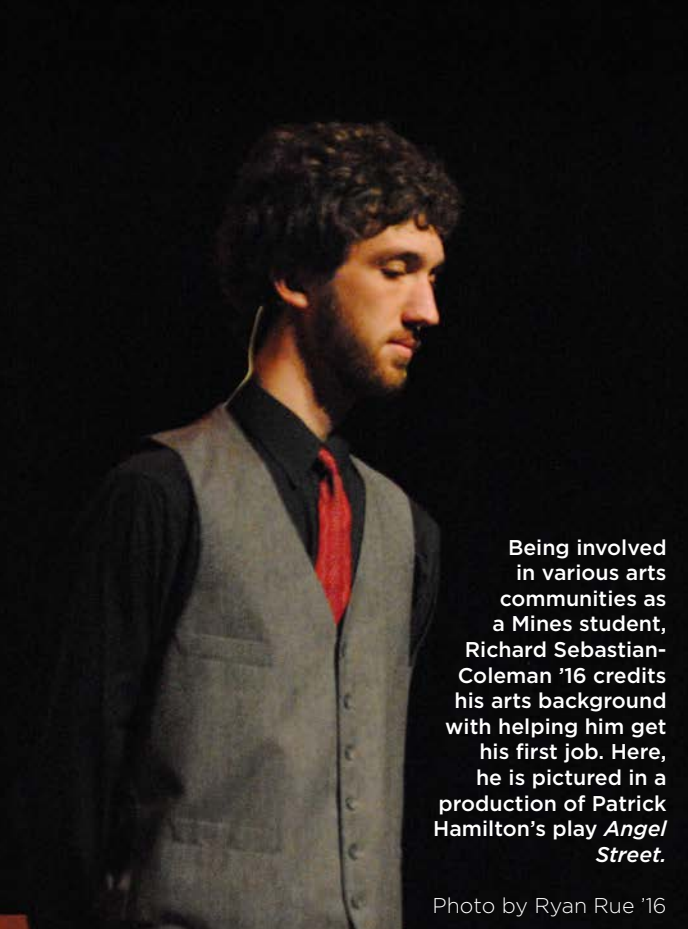
Founded in Spring 2016, this club teaches students improvised comedy and has a performance team which performs at theaters along the Front Range. For more information, email jbales@mines.edu.

MINES LITTLE THEATRE

A free, student-run club that puts on several plays in the fall semester and a musical in the spring semester. Recent productions include "Young Frankenstein" and Shakespeare's "A Midsummer Night's Dream." Find the club on Facebook for more information.

MINES PHOTOGRAPHY CLUB

One of the fastest growing clubs on campus, the group was created to provide students with a platform to share their passion and love for photography and improve their photography skills. To see student work and for more information, visit the club's Facebook page.



Being involved in various arts communities as a Mines student, Richard Sebastian-Coleman '16 credits his arts background with helping him get his first job. Here, he is pictured in a production of Patrick Hamilton's play *Angel Street*.

Photo by Ryan Rue '16

For Richard Sebastian-Coleman '16, senior year at Mines was an exceedingly busy one. But not in the way some might imagine for a budding engineer.

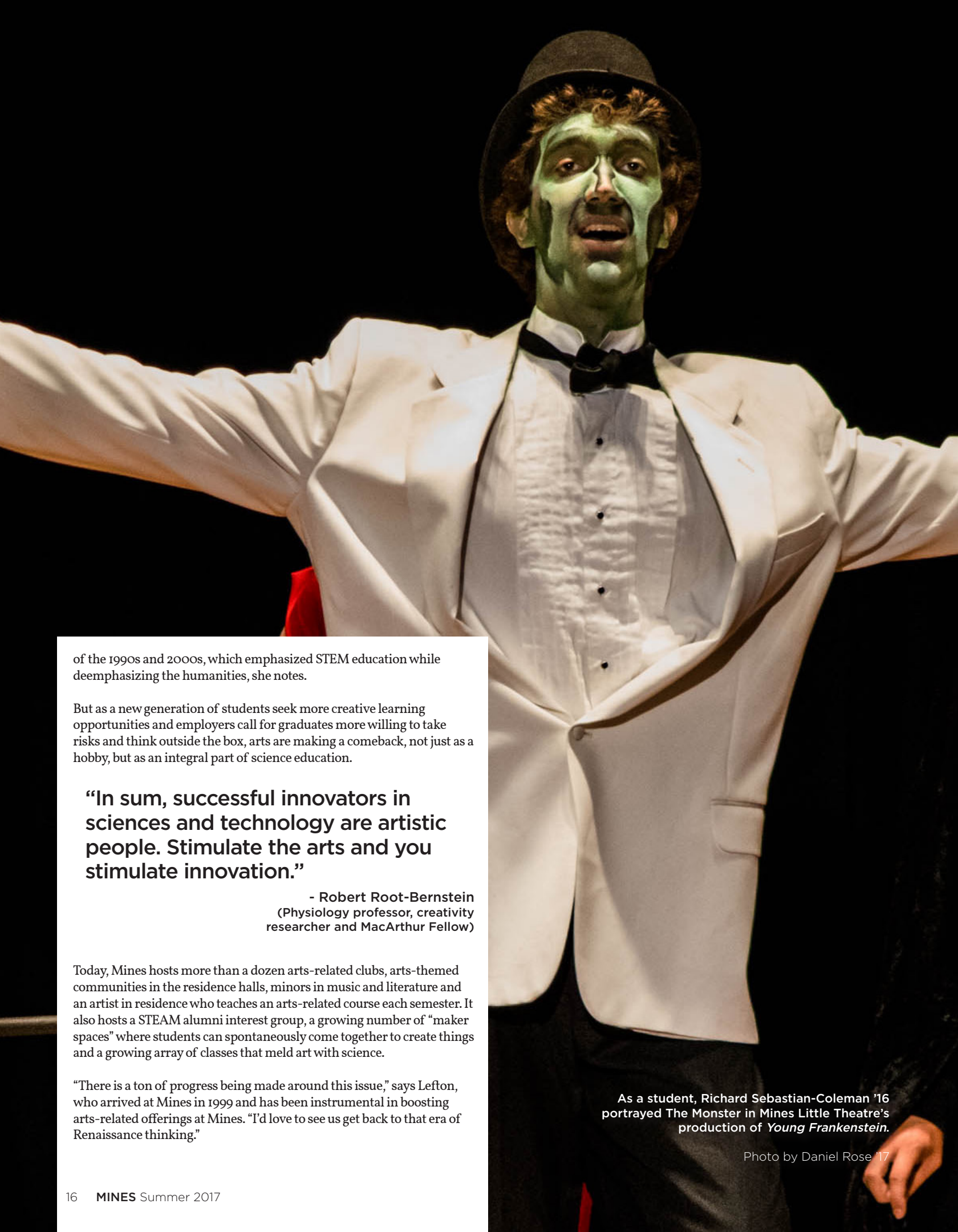
On weeknights, he raced from his last lab to rehearse with the orchestra or string quartet. Weekends brought rehearsals with Mines Little Theatre, where he portrayed Egeus in Shakespeare's *A Midsummer Night's Dream* and The Monster in *Young Frankenstein*, while also serving as the club's president. In the wee hours of morning, after his homework for his wastewater treatment class was complete, he often turned to reviewing poetry and art submissions for *High Grade*, the school's literary arts journal, of which he coedited.

"In terms of breadth, Mines had a huge amount of opportunity for a student interested in the arts," says Sebastian-Coleman, who now works as an environmental engineer in Colorado Springs. "I felt like it gave me a unique mindset. It also kept me sane."

Sebastian-Coleman's experience illustrates what many see as a welcome new embrace of the arts by Mines and other STEM-focused institutions in recent years.

"In the past 10 years, there has been a growing interest in reintegrating STEM and the arts—in turning STEM into STEAM," says Mines literature professor Toni Lefton, referring to a burgeoning national movement calling for science, technology, engineering, arts and math (STEAM) to become the new acronym for informing policy and education.

While art and science were once viewed as inextricably linked—think Leonardo da Vinci and other polymaths of the Renaissance era—that ideal largely fell away with the Industrial Revolution, explains Lefton, replaced by silos in which science was seen in one realm, driven by facts, and art in another, driven by emotion. This disconnect was exacerbated in part by the budget cuts of the 1980s, which hit the arts hard, and educational policies



of the 1990s and 2000s, which emphasized STEM education while deemphasizing the humanities, she notes.

But as a new generation of students seek more creative learning opportunities and employers call for graduates more willing to take risks and think outside the box, arts are making a comeback, not just as a hobby, but as an integral part of science education.

“In sum, successful innovators in sciences and technology are artistic people. Stimulate the arts and you stimulate innovation.”

- Robert Root-Bernstein
(Physiology professor, creativity researcher and MacArthur Fellow)

Today, Mines hosts more than a dozen arts-related clubs, arts-themed communities in the residence halls, minors in music and literature and an artist in residence who teaches an arts-related course each semester. It also hosts a STEAM alumni interest group, a growing number of “maker spaces” where students can spontaneously come together to create things and a growing array of classes that meld art with science.

“There is a ton of progress being made around this issue,” says Lefton, who arrived at Mines in 1999 and has been instrumental in boosting arts-related offerings at Mines. “I’d love to see us get back to that era of Renaissance thinking.”

As a student, Richard Sebastian-Coleman '16 portrayed The Monster in Mines Little Theatre's production of *Young Frankenstein*.

Photo by Daniel Rose '17

THE LINK BETWEEN ART AND SCIENCE

Reach back into the history books and you'll find a long list of famous scientists who got their start in the arts. Long before Alexander Graham Bell invented the telephone, he was a gifted childhood pianist. Samuel Morse, who developed Morse code, was an accomplished painter. Rufus Porter, who founded the magazine *Scientific American*, was a muralist and drummer.

One recent study titled "Arts Foster Scientific Success," by Michigan State University physiology professor and creativity researcher Robert Root-Bernstein, suggests that the most accomplished scientists also tend to be the most artistic. For instance, Nobel laureates, when compared to other scientists, were 22 times more likely to be actors or dancers, seven times more likely to be visual artists, and two to four times more likely to be musicians. They were also three times more likely to engage in some kind of art than members of the general public.

"In sum, successful innovators in sciences and technology are artistic people. Stimulate the arts and you stimulate innovation," concluded Root-Bernstein.

But exactly how does art inspire scientific advancement?

Neuroscience offers a few clues: A sweeping 2008 review by the Dana Arts and Cognition Consortium, a collaboration of neuroscientists using brain imaging to look at the link between arts and cognition, concluded that participating in performing arts boosts internal motivation and the ability to sustain attention: dance training strengthens neural networks that help students learn by observing, and music training enhances working and long-term memory as well as reading acquisition.

Others have pointed out that, fundamentally, artists and scientists have similar goals.

"Both are dedicated to asking the big questions placed before us: What is true? Why does it matter? How can we move society forward?" writes John Maeda, president of the Rhode Island School of Design and a leader of the STEM to STEAM movement. Creativity, he and others say, is central to finding the answers.

In engineering, a field where communication with diverse stakeholders is vital, the metaphors that art and literature provide can also serve as a common language, says Lefton, noting how illustrations, artistic graphic representations, storytelling and even poetry are being used in Mines' classrooms to elucidate everything from quantum physics to the structure of DNA.

"We have to come up with more innovative ways to teach this material, and integrating the arts into it makes it more accessible to different types of learners," she says.

The arts and humanities also foster something else that science, traditionally, has not been known to cultivate: empathy. And in careers like oil and gas development and mining, where decisions made can have a big impact on people's lives, empathy is key.

"How do you walk a moment in another's person's shoes? How do you empathize with your stakeholders and end users? There is no equation or textbook that is going to teach you that. That is what literature and music and the visual arts can do," Lefton says.

As a student, Lydia Muwanga '07 helped create the Creative Arts Club on the Mines campus. The club created the "La Luz de Minas" Mural in the Center for Technology and Learning Media building on campus to represent the diversity of leadership, talent, innovation and faces of Mines students and the leaders of tomorrow.

Photo by Leah Pinkus '16



HOW ART INFORMS SCIENCE

For Lydia Muwanga '07, the choice between arts school and an engineering education was an agonizing one. Growing up in Aurora, Colorado, she was winning coloring contests early in elementary school. By middle school, she realized she “had a gift.” And by high school, her art teacher was urging her parents to send her to art school. Wanting the best for her, they steered her toward Mines instead, where they imagined her skills in math and physics would take her far.

“I was determined to find a way to combine the two,” says Muwanga, who came to Mines in 2002 to study mechanical engineering.

At first, she was disappointed by the lack of arts offerings. “They didn’t have much. I knew we needed to do something about it.” She found a few like-minded visual artists looking for a place to come together, reserved a small room in the Student Center and displayed over 50 pieces of art from students across campus for the first art show. The Creative Arts Club was born.

Muwanga now owns a business, Suubi Innovations, using her unique skillset to create digital products, including websites and mobile apps. She notes that artists and engineers have something else important in common: they both “start with a purpose” and must create something out of nothing.

“Artists have a time when they diverge to generate as many ideas as possible and a time when they must converge and create the piece. It is a similar process for today’s engineers,” she explains, pointing to a trend toward “design thinking”—a creative early-stage brainstorming process with its roots in Silicon Valley. She learned design thinking after graduating from Mines from a product design firm that had creative engineers focused on brainstorming innovative ideas and creating one prototype to learn and iterate quickly. Muwanga says this process combined with creativity and innovation can help the world move forward.

For her, the earliest stage of the engineering process—the innovation—has come easier to her due to all those years of starting with a blank canvas and playfully experimenting with strokes before zeroing in on a strategy. “I think my background as an artist has made me willing to take more risks,” Muwanga.

HOW SCIENCE INFORMS ART

Award-winning photographer Evan Anderman MS '93, PhD '96 says that not only can art fuel good science—a science background can inspire novel forms of art.

“I was always interested in the technical aspects of photography—how the camera worked, what it would take to make a good exposure,” he recalls of a childhood in which he traveled the globe snapping photos alongside his dad (who operated an oil and gas company).

After more than a decade as a geological engineer, Anderman retired in 2005 to pursue a full-time career as a photographer, using his technological savvy and scientific eye to develop a unique craft he calls “social landscape photography.” An avid pilot, he bought a single-engine Cessna 206, had an autopilot installed to enable him to take photos from the air and fine-tuned his photographic techniques to reduce blur despite the plane’s swift forward motion. He has since dedicated himself to shooting photos of the Colorado landscape to bring awareness to things people might otherwise not see.

One bird’s-eye view collection of photographs, “In Plain Sight,” recently on display at the Denver Public Library, illustrates how humans have imposed themselves on the landscape, via everything from feed lots and chicken farms, to sprawling subdivisions, to coal-fired plants and oil and gas drilling operations. “I realize these are activities we need to help keep our society going, but I also think it’s important for people to know what the environmental costs are,” he says. “I hope my work will spark a conversation.”

ART FOR ART’S SAKE

Job skills aside, other alumni say the arts offerings at Mines gave them something that was harder to come by a few decades ago on campus: a reprieve from the academic pressure.

“There were days when I would go to the music room and just barricade myself in with my cello to get away,” recalls Jess Allen '16, who turned to composers like Bach and Rachmaninov for comfort when calculations and labs left her feeling stressed or hungry for something deeper.

- Jess Allen '16

“Engineering is wonderful. But there are certain things it just can’t give you, and for me, the arts have kept that part of me alive.”

“Engineering is wonderful. But there are certain things it just can’t give you, and for me, the arts have kept that part of me alive,” says Allen, who now works as a water resources engineer for Denver-based Calibre Engineering and plays in the Arapahoe Philharmonic.

Sebastian-Coleman has also maintained his double life.

By day, he works to keep Schlage Lock Company in compliance with environmental regulations. By night, he dons wigs and costumes and rehearses with one of several local theater companies, which quickly welcomed him into the community and helped him meet people when he first moved to Colorado Springs to start his new job.

He believes that engineers today need the arts more than ever.

“Before computers could do huge calculations, engineers had to do as much number crunching as designing. Today, much more is being asked of engineers. Being able to think creatively and about the broader impacts of your work can really set you apart, and it’s through participation in the arts that you get experience in asking larger questions,” he says. “I credit my arts background for helping me land my first job out of college. I was lucky to be at Mines when I was, at the beginnings of this movement toward more artistic thought. I hope it continues.”



A professional photographer and geological engineer, Evan Anderman MS '93, PhD '96 photographs landscapes from an airplane, showing a view of the Colorado landscape from a perspective most people might not otherwise see.

Photo by Evan Anderman MS '93, PhD '96



CATCHING CODE

Computer science is on the rise
at Mines and across the country

by **Mark Ramirez**

Computer science junior Nhan Tran found himself very popular at the most recent Colorado School of Mines Career Fair.

“Recruiters talked to me right away as soon as they saw that my name tag said ‘computer science,’ even when they’re not from tech companies,” said Tran, who’s interning this summer with Google’s Nest Labs, which develops and produces smart home products, and hopes to work in the tech industry after graduation.

This tremendous demand for computing skills across many industries translates into more students who want to major in computer science and more students in other programs taking computer science courses, challenging departments and universities across the country to meet the demand.

The number of computer science majors at doctoral-granting institutions has tripled in the past decade, according to a report released in February 2017 by the Computing Research Association’s Enrollment Committee, chaired by Mines Computer Science Department Head and Professor Tracy Camp.

At Mines, the number of computer science majors increased 61 percent between Fall 2011 and Fall 2016. The number of students pursuing a minor has grown every year for the last five years, and over the past three years, the Department of Computer Science has seen a 68 percent increase in the student credit hours it is teaching.

“Here at Mines, we feel that we are just starting to see the surge occur,” Camp said. “If you talk to Admissions, more students are applying with interest in computer science than they’ve seen in past years—450 accepted students listed CS as their potential major.”

The number of computer science majors at Mines has increased 61 percent between Fall 2011 and Fall 2016, making computer science one of the fastest growing programs at Mines, with similar trends appearing across the country.

Photo by Joe DelNero

That's almost 10 percent of the students admitted to Mines, said Kevin Moore, dean of the College of Engineering and Computational Sciences, which includes the Computer Science Department. He predicts computer science could soon be the third-largest undergraduate degree program at the university, behind mechanical engineering and petroleum. (The Department of Chemical Engineering has about 700 undergrads, but they are divided equally between two degree programs.)

"Seventy-seven percent of new STEM jobs require people who are trained in computing," Camp said. "Students and parents are realizing that there are a lot of unfilled jobs out there requiring computer science skills."

"There was a joke going around that oil companies were hiring more computer science graduates than petroleum engineers," said Sam Sartor, a CS major graduating in December 2018. "It's almost like the 2000s again," he said. "Internet services are huge."

"People I know in computer science are looking at web/mobile careers," said Jonathan "Sumner" Evans, a junior who plans to go into software development. "It's generally fairly secure right now."

But Sartor stresses that Mines grads are in high demand, because they can do more than just make a website. "Mines

teaches the fundamentals—how to solve problems, how databases are defined," he said. "Once you leave Mines, you can program anything."

Tran knows at least a couple of students who have switched majors from more cyclical industries or added CS as a second major to increase their chances of being employed. He's also seeing a lot more students in other programs taking intro-level computer science courses.

"I would highly, highly recommend that anybody in any industry pair their focus with computer science—even just understanding basic concepts and learning how to automate tasks."

- Blakelee Mills '10

Blakelee Mills '10 knows firsthand the value computing knowledge can add to a graduate's resume. The Mines alumna, who earned a bachelor's degree in applied mathematics, has served as CEO of Golden Software for the past two and a half years and has been with the company for nine. The firm

specializes in scientific graphics software, transforming data into easy-to-understand visual formats such as maps, graphs and models.

Founded in 1983 by Mines computer science instructor, Patrick Madison, and graduate mining student, Dan Smith, Golden Software serves industries such as mining, oil and gas, engineering and medicine. And while it employs quite a few Mines graduates, a computer science degree isn't a necessity.

"It can definitely go both ways," Mills said. "If you have a better handle on pure coding, you have to be curious about what the



Wendy Fisher MS '14, PhD '17 walks students through a computer science project in the Blaster Design Factory.

Photo by Joe DelNero



Computer science is on the rise, a demand for computing skills making students such as Jack Rosenthal, Jonathan “Summer” Evans, Sam Sartor and Nhan Tran some of the most sought after candidates in many industries, even outside of tech companies.

Photo by Mark Ramirez

customer wants. On the flip side, a self-taught programmer with industry experience also needs to be curious on the development side. They can both succeed.”

While Mills only took the basics in computing at Mines, she encourages current students to learn more. “I would highly, highly recommend that anybody in any industry pair their focus with computer science—even just understanding basic concepts and learning how to automate tasks,” she said. “There’s always room for the computer science component.”

The emerging Internet of Things—where everyday objects are connected and constantly sending and receiving data—and the need to process all that data and keep it secure will also provide many opportunities for computer scientists.

So while the economic benefits of studying computer science are easy to understand, the possibility of pairing it with myriad pursuits is another reason students are flocking to the discipline.

Tran’s passion, for example, is robotics. While electrical and mechanical engineering play huge roles in the development of robots, growing emphasis on autonomy and artificial intelligence means computer scientists are critical to the latest advances in the field.

He also wants to strike out on his own after putting in some time with industry to learn the business and make connections. “I have ideas in mind from hackathons and collaborations I’ve participated in,” Tran said. “A third of the computer science people I know would love to do a start-up, because with coding you

can make anything—make a new app, a new website,” all without having to, say, find a manufacturer as you would with a physical product.

Sartor, who has been passionate about computer graphics since discovering the joys of the sandbox video game Minecraft, is interested in exploring how virtual reality technology might be applied to

business. “I’m going to start my own company—I can’t sit still working on other people’s projects,” he said.

This diversity can also be seen in the research taking place across the Mines campus.

Computer Science Assistant Professor Hua Wang recently received an NSF CAREER Award for a research project to mine various kinds of data to detect neurological diseases, such as Alzheimer’s or Parkinson’s, sooner. It’s an approach that could be used to address other conditions, such as HIV/AIDS.

Another NSF CAREER Award recipient, Mechanical Engineering

“A third of the computer science people I know would love to do a start-up, because with coding you can make anything—make a new app, a new website.”

- Nhan Tran

Assistant Professor Xiaoli Zhang, is developing robots that are easier to control because they anticipate what their operators are trying to accomplish. Autonomous robots and intelligent machines are also the focus of research in mining engineering. Computer Science Associate Professor Qi Han is part of a project to design a network of sensor nodes and smartphones to improve safety in mines underground by detecting signs of danger and helping direct rescue efforts during emergencies.

“I think a lot of smart kids understand that there are great job prospects in computer science, and it’s also an intellectually pleasing field to be in,” said Moore. He says computer science students are some of the smartest students at Mines, and “they see it as a way to get their geek on, to be in a field where they can do the algorithmic stuff and get a good job.”

In addition to national trends, changes in how computer science fits into the structure of Mines may have also played a role in the recent growth of the program.

From the 1990s up until 2012, the university had a Department of Mathematical and Computer Sciences, offering an undergraduate degree of the same name, and students could choose an emphasis in applied mathematics, statistics or computer science. This changed with the establishment of the Department of Electrical Engineering and Computer Science and the creation of BS, MS and PhD programs in computer science. Now EE and CS are their own departments, giving even more prominence to the program.

“Certainly, creating those named degrees affected the visibility of the program and made it more attractive,” Moore said. Moore also believes a course called Introduction to Computer Science is persuading students to enter the discipline. “We have great faculty in CS, especially the teaching faculty who do a lot of the core program,” he said.

But all this growth does not come without its challenges. Diversity is a concern, with a student population that is mostly male. Computer science faculty are teaching more credit hours than ever, and Camp is not inclined to limit the number of non-majors in CS courses or charge additional fees, as other institutions have done. In fact, she wants more students to be required to take them. “I strongly believe every major at Mines should be taking a class or two in computer science,” she said.

Moore has made faculty hiring in CS a priority, although high demand for PhD graduates in academia and industry makes this challenging as well. “There are more positions than there are people,” Moore said, but they’ve had recent success in their searches.

The department has also been innovative in providing access to students, using TAs and “flipped classrooms” where instruction is delivered online while class time is spent writing code. “It’s more collaborative,” Moore said. “They use the web as a resource, and they’re up there on the cutting edge.”

The department will need to stay on the cutting edge to keep up with a field that offers limitless possibilities. “You could fill a bookshelf with encyclopedias of what happens when you type a simple search into the basic Google box,” said Sartor, as an example. “Computer science is a layer cake, and no single person in the world understands how the whole thing works.”



Mines Teaching Associate Professor Jeff Paone teaches a computer science class.

Photo by Joe DelNero

THE OREDIGGER STANDS STRONG

Mines' student newspaper encourages students to share their voices and remains a lasting tradition on campus

For nearly a century, *The Oredigger* has served as the voice of Mines students. Within hundreds of archived volumes, articles explore the history and evolution of the university, its students and its faculty. From the Roaring Twenties, to the cultural revolution of the 1960s, to today's current events, the student publication has chronicled the dynamic spirit on the Mines campus through the decades.

Printed across the masthead of the very first issue of *The Oredigger*, published March 21, 1921, is "O Miners, when expelled from other habitations, make this thy hangout." As a publication on a science and engineering campus, this first edition established clear and unique goals to serve its target audience by focusing on topics other than research, declaring that a school newspaper "should be the history of the institution and its personnel, but in no sense should its province be that of a technical journal ... *The Oredigger* is destined to be the true barometer of the quality of the old Mines Spirit."

There are surprising similarities between the spirit embedded within the earliest issues of *The Oredigger* and the publications that are delivered across campus today. Articles cover the M Climb, athletics and campus events, as well as academic awards and department honors. But the way stories are written has drastically changed since 1921.

"Before we had the Daily Blast and before social media became the way to be informed about what was happening on campus, *The Oredigger* was the only way to get information," 2016-17 editor-in-chief Katharyn Peterman said. "If you look back at some of the old issues, they talk about everything."

The contrast between past and present content is stark. Issues of *The Oredigger* from the 1920s ran articles that would pass the 140-character limit on Twitter today: "Miss Irma Downes, the librarian, was unable to attend to her duties for a few days last week because of illness;" "The April Quarterly will be ready for distribution this week;" "If plans materialize, an elective elementary course in French will be given next year." Today, writers for *The Oredigger* delve into the details to more extensively feature Mines events, clubs and the student body.

"*The Oredigger* has become a way to highlight things on campus more in-depth than the Daily Blast or a Facebook post can," Peterman said.

"When there were no other resources, you relied on the newspaper," 2017-18 editor-in-chief Erica Dettmer-Radtke said. "Now, I think we are forced to be more creative, because we are competing with so many other news sources like Facebook and Instagram."

Writers and editors contribute their own unique style and voice to the longstanding publication, while new technologies and programs empower the staff to explore more of campus and Golden than



Arthur Lakes Library on the Mines campus has a special collections archive, which holds all past issues of *The Oredigger*, among other interesting finds. Here, Special Collections Librarian Nick Iwanicki pulls down an archived issue of *The Oredigger*.

Photo by Joe DelNero

ever before. But Bill Wilson '65, business manager of *The Oredigger* in 1963, said the skills he learned working on the paper are still applicable to everyday life. "I got a lot of experience in managing things and that really did me well in my career," he said.

Wilson managed the ad space, working by hand to prepare *The Oredigger's* layouts. "At 6 o'clock every Saturday morning, I would go down to the printers," he said. "If we got a solicitation for an ad, we had to have what they wanted. My job was to lay it out before the editorial staff could fill in the rest of [the paper]."

Today's staff still experience the long hours working on layouts—though now the process is entirely digital—and continue to learn valuable lessons from the print journalism industry that affect their career development and professional goals in the science and engineering fields.

"I've learned time management, how to lead people and a lot about business because this is a lot like running a small business," Peterman said.

"My journalism skills have gotten better and my eye for detail has improved," Dettmer-Radtke said. "In my papers and in my reports, I focus a lot more on the little things, which might take more time, but overall it makes a project more presentable."

"We know what is interesting to our generation. We can change as the year or as the semester goes on, which means we can keep an audience."

- Erica Dettmer-Radtke

As students rotate through their time at the university and with the publication, *The Oredigger* evolves to serve a changing campus population. "We can gauge our audience," Dettmer-Radtke said. "We know what is interesting to our generation. We can change as the year or as the semester goes on, which means we can keep an audience."

Today, the masthead of *The Oredigger* reads, "The student voice of Mines since 1920." And the publication staff sitting in their office on the first floor of the Student Center take this journalistic mission to heart, tirelessly working to represent the broader student body. "It allows students to have a platform to discuss problems or good things that are happening on campus," Peterman said. Dettmer-Radtke added that *The Oredigger* is "providing a news source by students for students."

The Oredigger staff is a mix of creative students from various engineering and science disciplines. So what draws these students to print journalism? For Wilson, in the mid-1960s, simple word of mouth brought him into the publication. For Dettmer-Radtke, pursuing stories for *The Oredigger* has opened doors.

"The opportunity to network on campus and all the people you get to meet is such an asset," she said. "You get a lot out of this. And you get to learn a lot more about what's going on around campus."

"If you look at our staff, we want to be involved in something that produces something that all of campus gets to see," Peterman said. "We are trying to truly be the students' voice at Mines."

Stay up to date with what is happening on the Mines campus and what our student journalists have to say by picking up the latest issue of *The Oredigger* around campus or by visiting oredigger.net.

By Joe DelNero



The Oredigger editors Katharyn Peterman and Erica Dettmer-Radtke review one of the latest issues of the student newspaper.

Photo by Joe DelNero



Mines is looking to increase its female population, encouraging more women to apply to Mines through programs such as the Alumni Association's Women of Mines interest group.

Photo by Deirdre O. Keating

WOMAN TO WOMAN

ALUMNAE ENCOURAGE FEMALE STUDENTS TO CONSIDER MINES



Admissions data shows that there are plenty of female students applying and being accepted to Mines. But when it comes time for them to commit to becoming an Oredigger, the numbers follow a downward trend. To help reverse this and achieve Mines' goal of increasing the number of female students on campus to 40 percent, the Women of Mines alumnae interest group strives to engage alumnae and campus partners and encourage women to pursue their passions at Mines.

The group is currently working closely with the Office of Undergraduate Admissions to encourage accepted female students to commit to the university. One of the most successful programs they're involved with is admission's Making the Connection events. Alumnae are encouraged to sit on a panel for accepted students and their parents to talk about their Mines experience and professional success.

"I like having the opportunity to connect and reach out to other women who are in similar situations and try to help facilitate any conversations and questions they might have and help show them the opportunities available at Mines," said Beth Hutchinson '07. Hutchinson, who works at United Launch Alliance, wanted to impress upon prospective students that Mines is a place where lasting relationships are made and that students are fully supported, regardless of their gender.

During the 2016-2017 recruiting season, Mines held six Making the Connection events on campus and had a total of almost 200 prospective students and their parents attend, with both groups saying the alumni panel was a huge help in making this important college decision. Although the events have been held for the last 10 years, 2016 was the first year the alumni panel was incorporated into the programming.



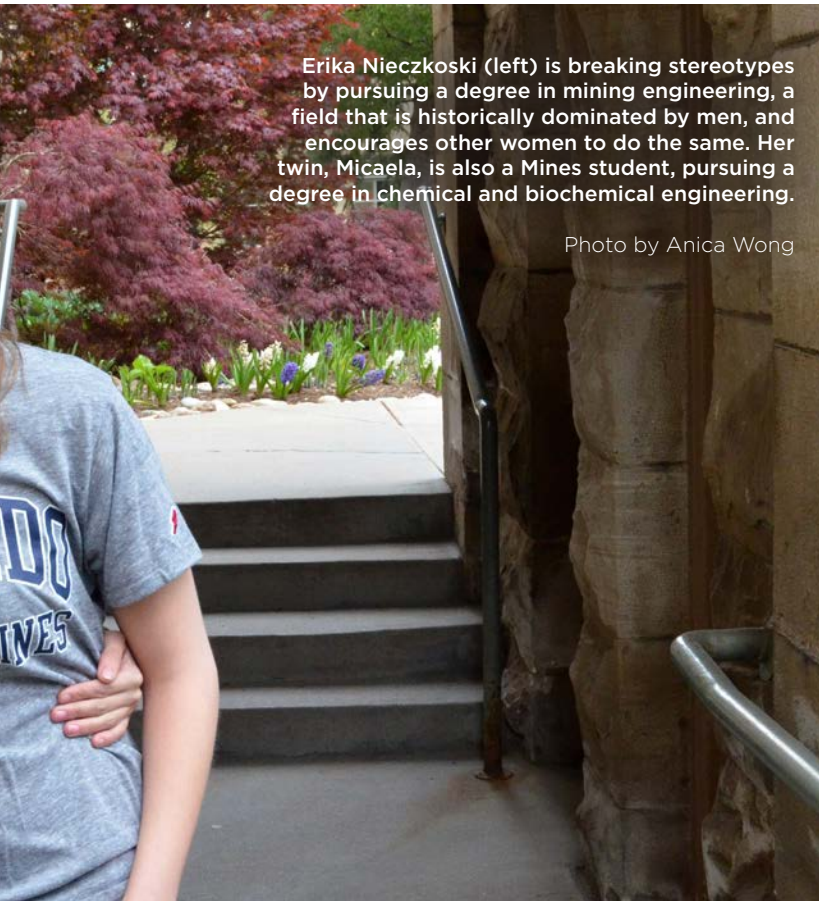


Mines is engaging alumnae and campus partners to encourage women to pursue their passions at Mines, like computer science student Megan Kallis is doing.

Photo by Jessica Hochreiter

Erika Nieczkoski (left) is breaking stereotypes by pursuing a degree in mining engineering, a field that is historically dominated by men, and encourages other women to do the same. Her twin, Micaela, is also a Mines student, pursuing a degree in chemical and biochemical engineering.

Photo by Anica Wong



“Alumni tell the story better than any statistic,” said Kim Medina, director of admissions. “They add that personal touch. The students feel like they can ask questions about what to expect at Mines, and the parents see that women who come to Mines are well-rounded and successful when they graduate.”

Breaking stereotypes about what kind of students come to Mines and go on to be engineers is also a critical piece of the interest group and these events. Of the 30 students in the Mining Engineering Department’s 2017 graduating class, only two are women. “I think one summer when I was working in the mines, I realized oh, there is a difference here. As you get into more specialized classes you notice you’re the only girl,” said Erika Nieczkoski, a mining engineering student expected to graduate in the fall. That didn’t stop her from pursuing that degree; she made sure the men in her class knew she could do anything they could do, including using a 150-pound jackleg drill.

When KarrieLee Abelein ’03 was looking at schools, she had a preconceived notion that “engineering was only for those really dorky smart boys.” But she was recruited to play softball at Mines and fell in love with the university. While on the panel, she made sure to tell the prospective students that there is more to Mines than meets the eye. “I like to come to those events to show girls that you can be a girl and be an engineer. You can be a mom, an athlete, social, be a ‘normal’ person—not just a dorky boy—and be smart!”

Keturah Baxter, a chemical and biochemical engineering major set to graduate in 2017, knows firsthand how important an inside scoop can be before coming to Mines. Although she started college before the alumni panel was offered, she was able to turn to her mom’s friend for guidance.

“She graduated from Mines in 1995 when there were still urinals on the girls’ dorm floors. I do wish that someone had reached out and told me more about opportunities in Society of Women Engineers (SWE) and things like that because I didn’t really get involved until my junior year,” Baxter said.

With quality feedback (65 percent of the students who attended Making the Connection events within the past year have committed to enroll so far), the admissions office is looking to find new ways to bring together students and alumni, with more of a personal touch.

One reason accepted students turned down Mines was that they received personalized attention from other schools and felt more welcomed than they did at Mines. Alumnae in the Women of Mines interest group, along with SWE and other groups on campus, have started sending personalized postcards to accepted female students, congratulating them on their acceptance and encouraging them to enroll at Mines.

“The female students applying to Mines are applying to eight different schools versus the seven that the male students are applying to. The competition for strong women is fierce, so these postcards offer an easy way for alumni to connect with students and have a big impact,” said Medina.

For more information about joining the interest group and how you can get involved, visit minesalumni.com/womenofmines or contact Melanie Westergaard ’87, the alumna leader of the interest group, at minesalumni@mines.edu.

By Anica Wong

ALUMNA PROFILE

A LABOR OF LOVE: CARING FOR SLED DOGS

Some people like to celebrate getting their master's degree with a vacation or dinner at a fancy restaurant. But all T.C. Wait '93, MS '01 wanted to do was drive a dogsled.

Fascinated by Alaska's Iditarod race as a child, Wait talked her mother into taking her on a weeklong graduation trip to Wyoming, where they zipped along in husky-pulled sleds. Wait liked the experience so much that she took her husband, Dave Wurts, on another mushing trip soon afterward. He liked the thrill as much as she did.

In fact, they both liked the experience so much that the couple returned home to Colorado with Sally, a tiny sled dog runt that no one wanted. "I hooked her to my bike, and we went all over the place," Wait said.

The dog wasn't the only one hooked. Shortly after, the couple got a second dog to pull Wait's bike. "I thought, if we get two more, we can put them on a sled and have a four-dog team," she said. They did, and as Wait noticed how much the animals seemed to thrive on pulling a sled, they couldn't resist adopting even more sled dogs. Today, they have a motley crew of 20, composed of retired Iditarod racers and shelter rescues.

Though she loves riding a dogsled, Wait never wanted a competitive racing team herself and really loves the animals more than the sport. Seeing the dogs' need for exercise gave her compassion for shelter dogs and former racers no longer fast enough for the Iditarod but still raring to go. "A lot of dogs need a good home," she said.

In 2004, Wait and her husband began traveling to Alaska every year to help with Iditarod logistics. They eventually bought 20 acres in Willow, the usual starting point of the race. Little by little, they saved up to build a cabin that they designed and built together.

Every winter, they transport their 20 dogs and two cats over 3,000 miles from Colorado to Willow in a pickup with built-in boxes to safely transport the dogs. They spend the season dashing along sled trails with their non-racing team and caring for Iditarod dogs that have become excessively tired or injured during the race. The animals are flown to Anchorage and picked up by people like Wait, who care for them until their owners can pick them up at the end of the race.

"These dogs want to run, even if they can't race. We have 13-year-olds that run 30 miles a day. If they're not running they get destructive, digging holes and barking," she said.

The couple has made many sacrifices to care for the dogs. Wait now works part-time or seasonal jobs so she can spend five months a year in Alaska, and every extra penny goes toward dog supplies and

"I love the working bond between me and my dogs when we're out."

- T.C. Wait



T.C. Wait '93, MS '01 spends every winter up in Alaska to help with the Iditarod, caring for racing dogs who become excessively tired or injured during the race until their owners return after the race. She also has her own non-racing team made up of shelter dogs or dogs that are no longer fast enough for the Iditarod.

Photo by Dave Wurts

veterinary expenses. Ministering to a couple of dozen dogs is no easy task, but for Wait, it's a labor of love.

In the summer of 2015, the couple's challenges multiplied when the Sockeye Fire swept through Willow, destroying 55 homes, including theirs.

"It was the worst feeling ever," Wait said. "It was our dream house, and we'd just finished putting on the final trim."

But the tight community, home to many mushers, pulled together. As the area began to rebuild, a local elementary school teacher called

Wait, who was in Colorado at the time, and said her class was building new doghouses for many of the local residents and painting them in bright colors and wanted to know if she would like some. The students built and painted 20 doghouses for Wait and many more for her neighbors—probably over 100 in all. This was just one example of the town's solidarity.

"The community up there is tremendous," Wait said. "People just showed up to haul debris or frame houses." By Thanksgiving that year, Wait and her husband, with the help of many others, had rebuilt their home enough to move back in.

Despite all the hardships she's endured, Wait doesn't think she'll ever give up her sled dogs. "I love the working bond between me and my dogs when we're out," she said. "It's an ancient and traditional way of exploring the world."

By Teresa Meek

RUNNING BACK TO LONDON

Elijah Kempton '00 (pictured center in the white shirt) completed this year's London Marathon. He was no stranger to the city, having previously lived and worked in London for six years for Assured Flow Solutions, a company that works with energy firms to ensure oil and gas flows smoothly from the well and through the field.

Kempton says the friends and experiences he built while working abroad created a worldwide network he calls on when projects back home, in Colorado and elsewhere in the U.S., require specific expertise.



Photo courtesy of Elijah Kempton

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OREDIGGERS GIVE BACK

LEAVING A LEGACY THAT ALLOWS STUDENTS TO SUCCEED



Al Ireson '47 was not one of Mines' wealthiest alumni, but he was among the most dedicated and loyal. He died in February 2017, just before his 96th birthday, but his lifetime of loyal contributions and his regular presence on the Mines campus left a meaningful impact on the school and the students of yesterday, today and far into the future. Because of his consistent generosity in giving what he could to the school, students in perpetuity will have access to the Mines education that Ireson valued so dearly with scholarship opportunities through the Alfred T. Ireson and Family Endowed Scholarship Fund.

The Alfred T. Ireson and Family Endowed Scholarship Fund, established in 2000, has supported at least 29 students so far. Through Ireson's after-lifetime gifts, this scholarship fund will continue to grow and provide financial help to more students at Mines.

Ireson generously deeded his home, located in Golden, to the university as a life estate gift. Per his direction, the funds from the sale of the house will be added to the scholarship fund.

In recent years, Ireson gave his required minimum distribution from his IRA to Mines, totaling almost \$40,000 each year. Mines was also a beneficiary of Ireson's IRA after his lifetime, providing the scholarship fund with an additional \$722,000.



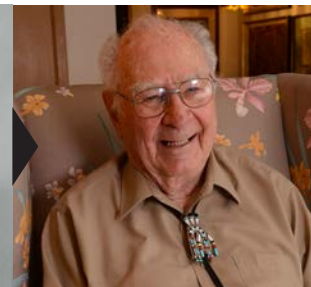
"The support I've received from the Al Ireson and Family Endowed Scholarship has made all the difference in pursuing a Mines degree. Al was one of the most genuine men I've had the pleasure of getting to know, and his contagious smile and laughter will be missed. Although Al is no longer with us, the legacy he built will continue to support Mines students like myself in earning a degree and ultimately building a career."

Nicola Lonardo, Chemical & Biological Engineering, Class of 2018



"Mr. Alfred T. Ireson's support through my time at Mines has had an enormous impact on who I am as not only a student, but as a person. His unmistakable respect for the school and the students that attend it inspire me to become the most successful engineer I can possibly be in hopes to one day give back to Mines."

Garret DeCarlo, Mechanical Engineering, Class of 2018



When Ireson was a freshman at Mines in 1940, tuition was only \$35 a semester. During his junior year, he was called into service in World War II, after which he returned to Mines to earn his professional degree in petroleum engineering; he went on to work for Shell Oil for 37 years.

Ireson believed with all his heart that the world needs Mines graduates to solve critical challenges and make a better tomorrow. Ireson, who attended athletic and alumni events right up until his passing, loved meeting with his scholarship students more than anything; one of his most prized possessions was a scrapbook of personal letters from his scholars.

ALUMNUS PROFILE

MANIACS FOR MINING EDUCATION

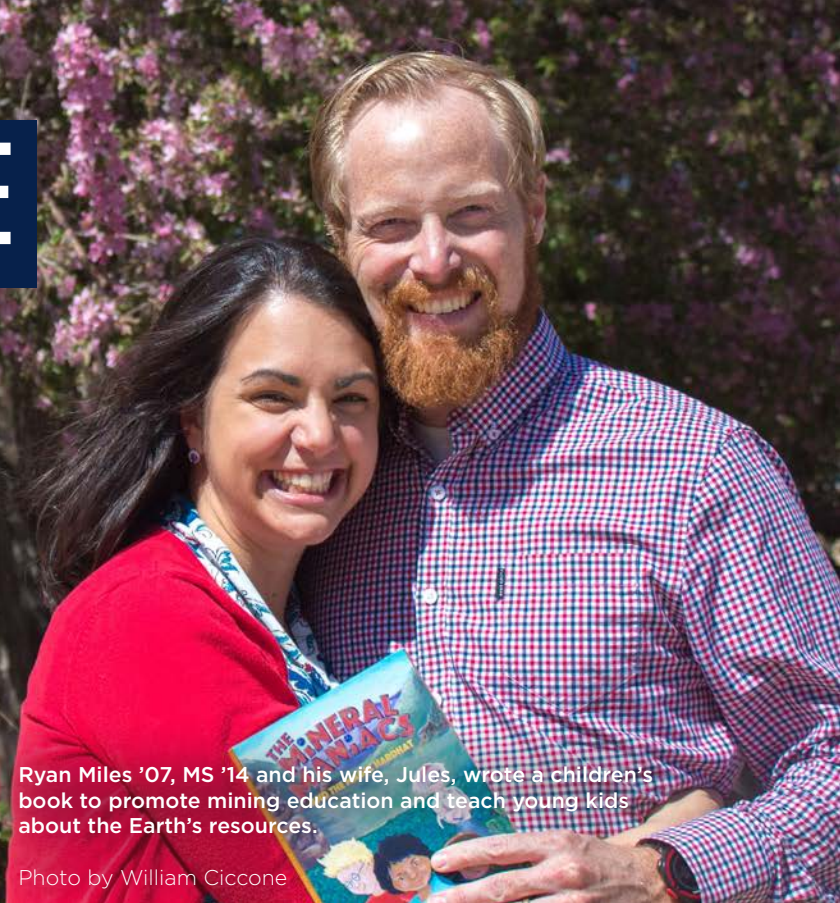
Ryan Miles '07, MS '14 was frustrated. As a mining engineer who frequently traveled for work, he consistently found himself talking to people who confused mining engineering with data mining. Additionally, many people didn't understand that mining is still a viable, thriving industry, critical to today's world. Ryan knew he had to do something to better educate people about his field.

He and his wife, Jules, began brainstorming ways to inform people about the importance of the mining industry—thinking about creating a blog, starting a YouTube channel or even the more traditional route of submitting articles to academic journals. But one night, as the couple read a book from *The Magic Treehouse* series to their oldest child, Jules had the perfect idea. "I thought, 'Why don't we write something for kids?'" she said. "They're so much easier to talk to, and we could teach them from a young age about the makeup of their world—a world made of rocks and minerals."

They ran with this idea and developed a children's book aimed at third- to fifth-grade students, called *The Mineral Maniacs and the Magic Hardhat*. The story follows the adventures of three young children—Marabel, Victor and Herbie—who find a magical hard hat in their science teacher's classroom and are magically transported to a world with creatures made of stone, called the Paxterras. The young friends must help the Paxterras stop the bad guy—a rogue Paxterra named Sulfur—from stealing the entire supply of a particular mineral essential to their world. Along the way, the main characters learn about the different components of mining extraction, processing and manufacturing. "Ultimately, by the end of the six-book series, the children have to build their own machine to try to stop Sulfur," Jules explained. "That's where a huge engineering component comes into play."

Yet, writing a children's book wasn't easy. Even though Ryan got his bachelor's degree in mining engineering and a master's in mineral and energy economics from Mines, he still had to do a lot of research to provide the background for the book. "As a mining engineer, the geology is already decided for you, and you're just focused on getting the mineral out in the most cost-effective and safe way possible," he said. "For me, it took a lot of research to refresh my memory, and I still have a lot to learn."

With background from Ryan, Jules drafted the story, but the couple really took a chance with their manuscript when Ryan came across an advertisement in *Mining Engineering Magazine* for a contest called "Move Mining." The contest called for projects aiming to change the perception of the mining industry. With the



Ryan Miles '07, MS '14 and his wife, Jules, wrote a children's book to promote mining education and teach young kids about the Earth's resources.

Photo by William Ciccone

deadline the next day, Ryan quickly drafted a concept of their book and decided to give the contest a shot. "Two weeks later, we were notified that we were one of the finalists," Ryan said. "We didn't win the contest, but after our presentation, we were approached by companies who wanted to partner with us. One of the companies already had an educational initiative for middle school students but had nothing for elementary-age children. Our book was a perfect fit."

"The mining industry is a necessary collaborator in modern technology, and we want to teach that to kids," Jules explained. "We are very specific in this first book to focus on a mineral that is found in electronics, because we want children to understand that the technology they've grown very accustomed to comes from somewhere."

And it just so happens that *The Mineral Maniacs* perfectly supplements the curriculum of its target age group. Third- to fifth-grade students in Colorado elementary schools learn about earth science, specifically rocks and minerals, as well as some mining and geology terminology that aligns perfectly with the adventures in the book. "We're hoping to develop a study plan for teachers to detail exactly how this book series will line up with

certain educational requirements and have some activity companions to go along with it," Jules said.

"We believe good storytelling can take kids on adventures to spark an early interest in science and technology," Ryan said. "It doesn't have to be either science or the arts; it's all part of who we are and where we are going."

To get your own copy of *The Mineral Maniacs* or to learn more about the series, visit themineralsmaniaks.com. The book is also available from Amazon and other bookstores.

By Ashley Spurgeon

"We believe good storytelling can take kids on adventures to spark an early interest in science and technology."

- Ryan Miles '07, MS '14

SUMMER 2017

ON OUR WALL

What extracurricular activities did you participate in as a Mines student, and how have those activities contributed to your success as a professional or in your day-to-day life?



I played intramural football, basketball, soccer and Ultimate Frisbee. Bonding with my fellow students and balancing studies with recreation helped me really enjoy my time at Mines and living in Golden.

- Jake Kramarz MS '15



I was the co-chairman of E-Days in 1976. Negotiating the rock concert led to my first experience with lawyers when we had to renegotiate the contract in the last two hours before the show.

- Richard Wilson Jr. '76



Being a Greek (SigEp) is what got me through school. We always had teams for intramurals, a support group for studies and a path to much-needed relaxation. I learned team-work, collaboration and negotiation by working within a broad personality dynamic—skills critical for the competitive working world that Mines prepares us to enter and become successful and influential leaders.

- Steve Biagiotti Jr. '86, MS '94

This past April, Mines Little Theatre performed *Pippin*, a Tony Award-winning musical about a young prince who longs to find passion and adventure in his life.

Photo by Julian Liu



I played football and belonged to a fraternity. I wouldn't do it any differently today; both helped keep me focused while in school and have aided in my professional development. Playing sports is a lot like life: it requires teamwork, sportsmanship, perseverance, determination and leadership. Nothing develops those characteristics like intercollegiate athletics. Being in a fraternity helped to develop lifelong friends, associates and business partners that have meant a great deal to me over the years.

- David Scriven '70



I was part of Mines Little Theatre, *High Grade* and the orchestra. I cannot speak enough to how much they improved my overall well-being at school. I continue to participate in theater and music groups post-graduation, which has been a great way to meet people. As I took leadership positions in these groups while at school, they also gave me very practical experience in running organizations and dealing with their relationships to the school and public at large. Being able to talk about that definitely helped me land my first job.

- Richard Sebastian-Coleman '16



Track & Field (hurdles, etc.), band (trombone), and intramurals (basketball, volleyball). Extra activities helped me with time management and helped avoid an unhealthy focus on work.

- Tom Stahr '85



I was very involved with the Minority Engineering Program (MEP) and was also in a sorority (Sigma Kappa). My involvement in these communities is honestly the reason I stayed at Mines, even through the hard times. The support you receive is priceless, plus the network you gain and relationships you make stay with you and serve you long after you graduate.

- Roxana Meza '12

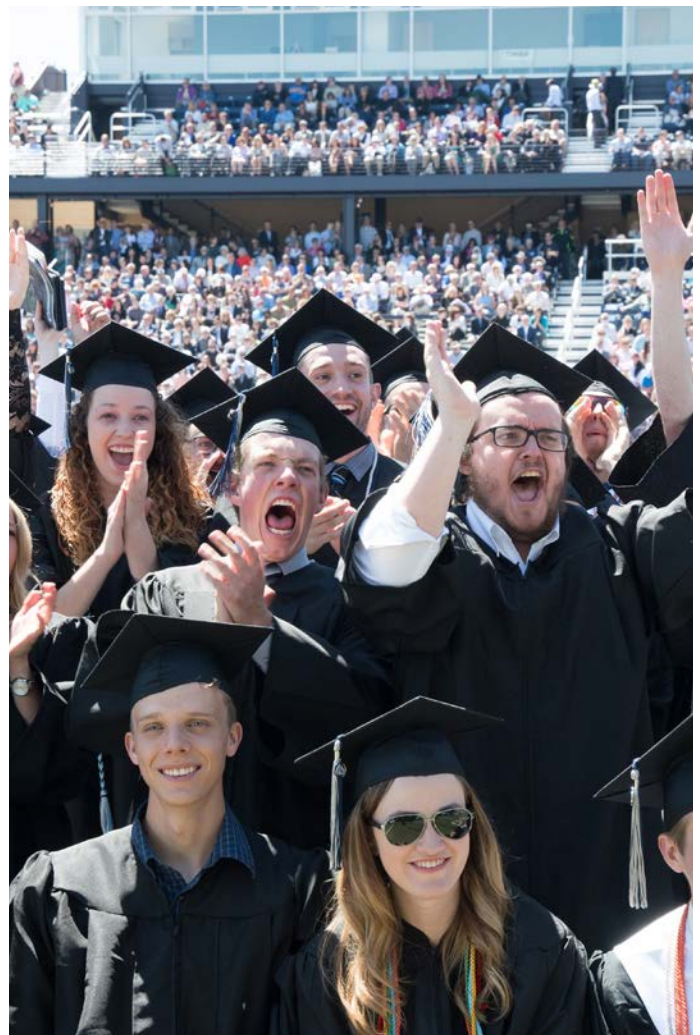
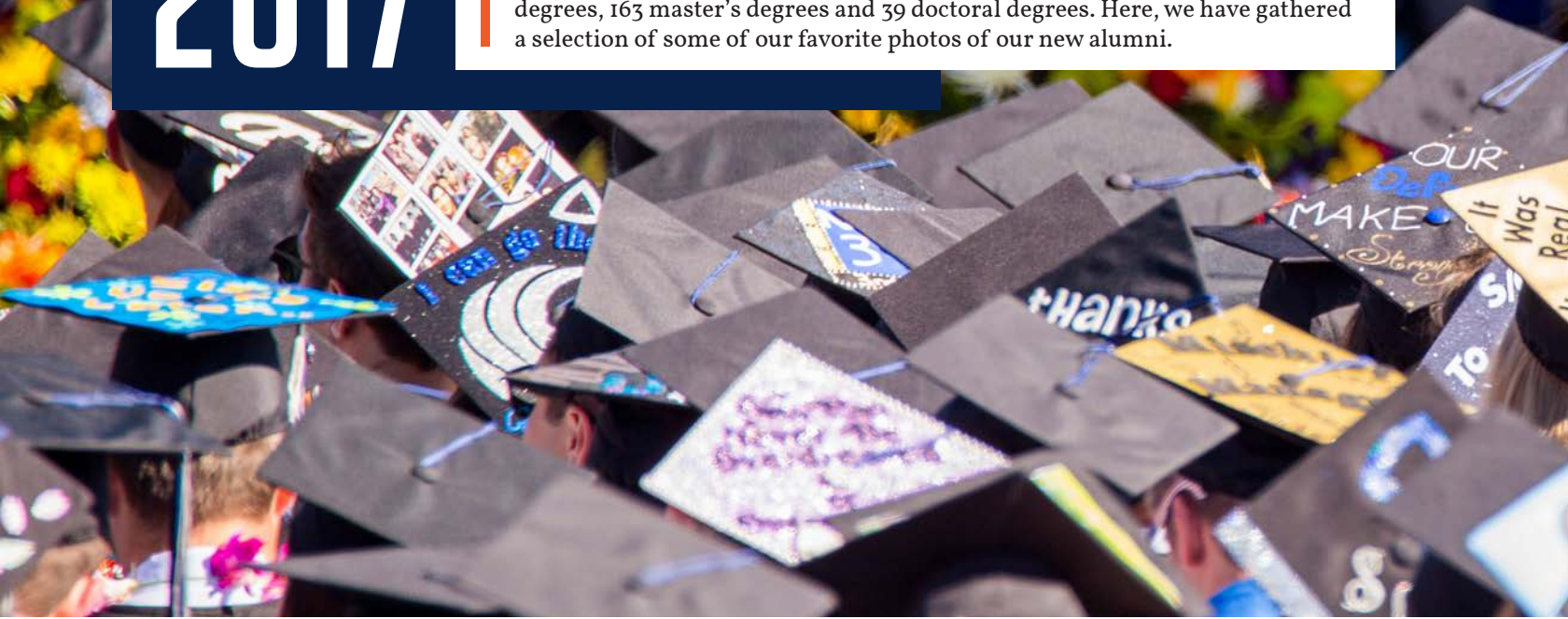


I participated in SWE, which finally convinced me that dressing professionally and having a good handshake is important.

- Kari Sanders '97

GRADUATION 2017

Mines welcomed its newest graduates into the alumni family at the 143rd annual commencement ceremonies on May 11 and 12, conferring 741 bachelor's degrees, 163 master's degrees and 39 doctoral degrees. Here, we have gathered a selection of some of our favorite photos of our new alumni.





ALUMNI NEWS



NEWS

MATT THIEL '75 and **STEVE ANDERSON** '75 recently participated in a bike ride on the Southern Tier cross-country route from San Diego to St. Augustine, Fla., with a group of 11 other riders. The 3,160-mile trip crossed seven states and took 58 days, 51 of which were spent riding. During the ride, the participants braved the mountains and deserts of the West, the headwinds of West Texas and the rainstorms and humidity of the Gulf Coast. Matt and Steve are pictured here in the jerseys they received from the Mines Cycling Club.



AWARDS

MICHAEL WAGNER PhD '17 was awarded the Dr. Bhakta Rath and Sushama Rath Research Award at Mines' May 2017 Graduate Commencement ceremony for his dissertation which presented a model for optimizing the dispatching of energy generated from concentrating solar power systems. The Rath Award is given for dissertations that demonstrate the greatest societal impact.

AWARDS



VINH NGUYEN MS '05, PhD '17 was awarded the Dr. Bhakta Rath and Sushama Rath Research Award at Mines' May 2017 Graduate Commencement ceremony for his thesis concerning the use of methane gas in fuel cells at low temperatures. Nguyen developed a platinum catalyst that is distributed more evenly, using more of the fuel cell's surface area, and developed an ionic liquid that allows methane gas and the water it needs to oxidize to diffuse at proper concentrations. The Rath Award is given for dissertations that demonstrate the greatest societal impact.

WHERE COLLABORATION AND ENGINEERING INTERSECT

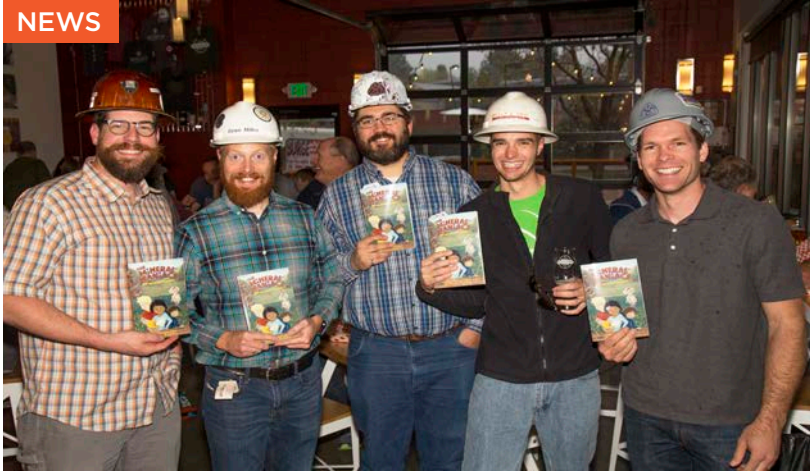


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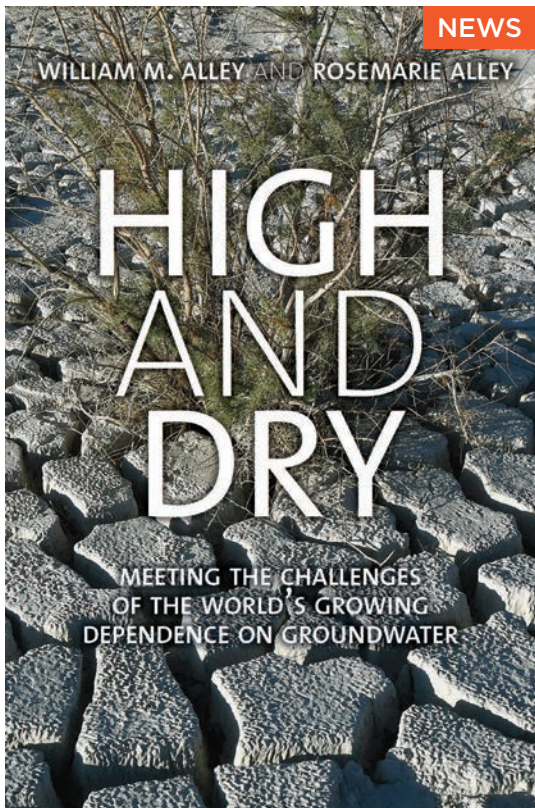
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NEWS



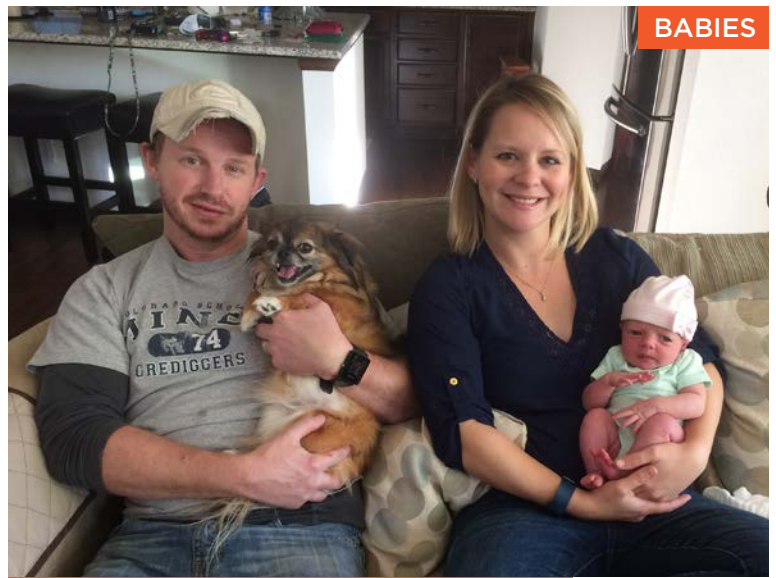
On May 22, 2017, **RYAN MILES** '07, MS '14 and his wife, Jules, held a launch party for their new children's book, *The Mineral Maniacs and the Magic Hardhat*. The book launch was held at Resolute Brewing Company, a Colorado brewery owned by Mines alumnus Clifton Oertli '07, MS '09. Several Mines alumni attended the event, including Garrett Whipp '07, Richard Diaz '07, MS '16, Michael Landers '07, John Spelic '09, Lyssa (Myerly) Walborn '09, Tara (Schwein) Bauman '10 and Ricky Walker '09, MS '11.

NEWS



WILLIAM ALLEY '74 and his wife, Rosemarie, wrote an authoritative book on the world's groundwater. Drawing on examples from around the world, including case studies in the United States, Canada, Australia, India and sub-Saharan Africa, the book examines groundwater from key scientific and socioeconomic perspectives. While addressing the serious nature of groundwater problems, the book highlights stories of people who are making a difference in protecting this critical resource. Dr. Alley served as chief of the Office of Groundwater for the USGS for almost two decades. (Yale University Press, 2017)

BABIES



STEPHANIE (WOLF) MEANY '07 and **RYAN MEANY** '07 welcomed their first child. Olivia Hayden was born on Oct. 20, 2016, joining her big furry sister Gizmo.

IN MEMORIAM

“When you are sorrowful look again in your heart, and you shall see that in truth you are weeping for that which has been your delight.”

-Kahlil Gibran



DUNSTON F. “DUSTY” BOYD '52 died April 3, 2017. Born in 1930 in Sewell, Chile, he received his professional degree in metallurgical engineering from Mines in 1952 and was a member of the Tau Beta Pi fraternity. Dusty served two years in the U.S. Army Corps of Engineers upon graduation. His career included employment as a research engineer for United States Vanadium

Corporation's property in Rifle, Colo., then as a mill superintendent at Liberian Mining Company's Bomi Hills Iron Mine. He also worked as an ore handling superintendent at Liberia American Mining Company's Iron Ore property in Nimba and Buchanan, Liberia. In 1968, Dusty moved to California, where he was employed by Kaiser Steel as a process engineer at the Eagle Mountain Mine. He later transferred to Kaiser Engineers in Oakland, Calif., and retired in 1984.

CHRIS H. DARNELL '85 died May 13, 2017, in El Paso, Texas. He was born in 1963, in Virginia Beach, Va. He graduated from Mines with a degree in geological engineering in 1985. He worked as an engineer throughout the Mountain West.



ARTHUR S. “ART” DICKINSON '50 died March 30, 2017. Art graduated from Mines in 1950 with a degree in geological engineering and was on the Mines track team. After graduating from Mines, he worked in the oil and gas industry for companies such as Shell Oil and Adams Petroleum. Art then ran his own companies, Target Resources and Surfside Energy.



DAROL E. CRAYS '59 died in April 7, 2017. He was born in 1936 in Las Animas, Colo., and graduated from Mines in 1959 with a degree in petroleum engineering. After graduation, he joined the U.S. Army Corps of Engineers and was discharged as a first lieutenant. Darol then began his petroleum engineering career with Texaco, Inc. He supervised the construction

of a refinery in Sicily, fulfilled two assignments in Houston and retired from the Port Arthur, Texas, refinery.



MICHAEL T. HUSAR SR. '66 died June 5, 2017. Michael was born in 1940 in Binghamton, N.Y., and graduated from Mines in 1966 with a degree in mining engineering. He worked for Amoco in Casper, Wyo., and Chicago. He was also a board member for Northville Township and WHOA.



LAWRENCE B. “BUCK” CURTIS '49 died Jan. 25, 2017. Born in 1924 in Grand Junction, Colo., he served in the U.S. Navy, where he was assigned to Naval Air Squadron VPB-15 as a radio operator. He served in the Atlantic, Panama Canal Zone and Pacific Ocean theaters from 1943 to 1946. After the war, Buck attended Mines, graduating with a degree in petroleum

engineering in 1949, which led to a position with Conoco in Texas oilfields. During his career with Conoco, he worked around the world, engineering technical solutions to improve the supply of oil to the American public, including the Dubai Kazaan submersible storage tank and the Hutton deepwater tension-leg platform. Buck retired in 1987 as a vice president of the company's production engineering services. Throughout his career and into retirement, he was active in the petroleum industry, receiving many prestigious awards and serving as the president of the Society of Petroleum Engineers in 1971, and later as chairman of the board of Energy Corporation of America.



ALFRED T. “AL” IRESON '48 died Feb. 25, 2017. Born in 1921, Al received a degree in petroleum engineering from Mines in 1948. He served four years in the U.S. Army Corps of Engineers during WWII, earning two Bronze Stars, the Good Conduct Medal and ETO Ribbon. Al spent his career in oil and gas operations and was heavily involved in the development of on-site oil shale and nahcolite technology for Shell Oil Company. He was a member of Kappa Sigma Fraternity and the Society of Petroleum Engineers. A member of the President's Council, Al was one of Mines' longest consecutive annual donors.



H. BOYD MORELAND '56 died Feb. 24, 2017. Born in 1930 in Saint Louis, Mo., Boyd enlisted in the U.S. Army in 1949, serving until 1952 and receiving three Purple Hearts for his service during the Korean War. He received his bachelor's degree in petroleum engineering from Mines in 1956. He later returned to school, earning a master's degree in petro-

leum engineering from University of Tulsa in 1961. Boyd spent his career working for Texaco and later as an independent petroleum engineer.



OLUSEGUN AKINYEMI ODULOWU MS '72, PhD '78 died Jan. 19, 2017. He was born in Ibadan, Nigeria, in 1943, and attended Mines on a Fulbright Scholarship, earning his master's degree in 1972 and his PhD in geophysics and mineral economics in 1978. Akin served as the managing director of Digicon Geophysical Corp. in Nigeria. He also served as an area geophysicist

for Geophysical Service Inc. and taught geophysics at the University of Ibadan. Akin also worked at the World Bank, where he spent much of his career assisting governments of developing countries in the development and management of their energy resources, serving as an energy planner, geophysicist and energy economist. He eventually became a lead energy specialist in 1995, working in that position until his retirement. Akin was a member of the Society of Exploration Geophysicists, the American Countertrade Association, the National Association of Procurement Management and the American Association of Petroleum Geologists. He was also a past president of the Vienna Host Lions Club. In 2006, Akin received the Distinguished Achievement Medal from Mines for his significant career achievements, which enhanced the reputation and mission of the university.



JAMES J. "JIMMY" SNODGRASS '63 died March 29, 2017. Jimmy was born in 1941 in Alamosa, Colo. As a Mines student, he earned his degree in geophysics from Mines in 1963 and participated in the ROTC program. He went on to serve as an Army first lieutenant in North Korea. Jimmy briefly worked in the oil and gas industry and retired from the Bureau of Mines,

where he worked on mining technology, safety and cleanup.



ROBERT S. "BOB" WARFIELD '48 died May 25, 2017. He was born in Fort Collins, Colo., in 1922. Bob was in the 739th Anti-Aircraft Artillery Gun Battalion during WWII and participated in the Pacific Ocean theater. He was awarded a Purple Heart when he was injured in combat. After he was honorably discharged from the military in 1945, Bob attended Mines, gradu-

ating as an engineer of mines in 1948. He worked for the Alaska Research Center of the U.S. Bureau of Mines in Juneau, Alaska. His early years were spent as a field engineer, and he later served as assistant chief of the research center. For over 20 years, Bob focused on sampling and evaluating various coal resources throughout Alaska. Upon retirement, Bob was awarded the U.S. Department of the Interior's Silver Medal for Meritorious Service.

Compiled and written by **Ashley Spurgeon**

To submit an obituary for publication in the magazine, visit minesalumni.com/obituaries.

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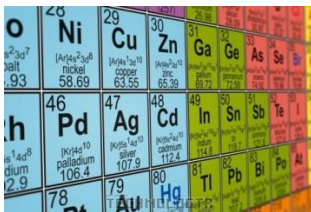
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PERFECT BALANCE

Clayton Kramp (applied mathematics and statistics, Class of 2018) loves photography, because he says it captures important moments in his life. "Through photos, I can see the transitions I have had in my life, and they are a way for me to relive my memories."

Kramp took this photo, titled "Clay and Gen," to reflect his life at Mines. "I really feel that Mines has exposed both my professional and academics-driven side, as well as my more goofy, active and energetic side," he said. Shot on the top of South Table Mountain in Golden, Kramp set up his camera on a tripod and ran a self-timer to take two shots of himself and then merged the photos. He also said that the title he chose for the piece reflects his first and middle name. "I have always thought that my English first name, Clayton, brought out my professional side, while my Japanese middle name, Genki, reflected my active side—as Genki in Japanese, with different character combinations, literally means 'happy' or 'energetic,' he said. "The shortened version, Clay and Gen are the perfect mediums to balance out my personality."

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- Clayton Kramp

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