

Water in the West

Mines Marches in Dublin

Orediggers Winter Recap

Summer 2016 Volume 106 Number 3

Mines

COLORADO SCHOOL OF MINES MAGAZINE



Jenny & Melinda, Homecoming 2013

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Cover image: Jenny Wolicki '16 (left) and Melinda Krebs '15 are two of Mines' newest alumni. During Homecoming events in 2013, an epic tug-of-war battle left them covered in paint. (Image by Chelsea Panos)

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CoorsTek Center Groundbreaking On May 2, 2016, officials from CoorsTek, the Coors family, and Mines broke ground on the new CoorsTek Center for Applied Science and Engineering, an interdisciplinary academic and research facility. Watch the video of the groundbreaking ceremony and learn more about this new addition to the Mines campus.

Mines Student Wins Video Contest Watch student Joshua Pelz's video, *Molten Movement*, which won a \$500 prize in the Association for Iron & Steel Technology Foundation's 2016 "Real Steel" Marketing Video Challenge. The contest challenges students to create videos that promote careers in the steel industry and educate viewers on how the industry has changed in terms of environmental consciousness and responsibility.

Q&A with NASA summer Intern Hanna Flamme Read Mines' conversation with geophysical engineering student Hanna Flamme, who was selected to participate in the NASA Student Airborne Research Program this summer. She will receive hands-on research experience in surface, atmospheric, and oceanographic processes.

Mines Visits Dublin During spring break, alumni, family, and friends traveled with the Mines Music Program to Dublin, Ireland. If you missed the fun, watch the video of the Mines Marching Band in the 2016 St. Patrick's Day parade. To view other photos from the trip, search #minesdigsdublin on social media. Read more about the Dublin trip on page 24.

Mines Tiny House Team Prepares for a Solar Decathlon Read about the efforts of a student-led group to build a tiny house—a 200-square-foot house to be used for research and teaching purposes. The team aims to design a structure that will compete in the U.S. Department of Energy Solar Decathlon, a contest to determine which university can build the most efficient, affordable, appealing, and functional solar-powered house.

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Harry J., Jr. '70, MS '72 and Jane Briscoe

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Comments and suggestions are welcome. Contact us via our contact form at minesmagazine.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.

A New Era for the Mines Alumni Association

Since its inception in 1874, Colorado School of Mines has seen many changes, always evolving to meet the changing needs of industry and our global society. Mines is a special and unique institution, and we all share great pride in our connections to Mines and each other. The bonds forged between students during their time at Mines are incredibly strong—they reach around the globe, networked through 26,000 alumni.

In the spirit of evolution, and in the hope of enhancing the interconnectivity between our alumni and with Mines, we welcome you to a new era for Colorado School of Mines and its alumni association. You worked hard for your degrees, and we want to reward your efforts by welcoming you into the alumni association: an inclusive, no-dues network for *all* Mines alumni.

We are committed to enhancing your alumni experience through collaborative partnership between the Colorado School of Mines Alumni Association, the Colorado School of Mines Foundation, and the university. We believe this is important to the future success of our alumni and to the future of Mines. Our goal is to have an alumni network that other universities strive to replicate, and that we are the model for interconnectivity, affinity, and impact.

Read more about our new programs and enhancements on page 21, and visit minesalumni.com/WeAreMines today to see what's in store, get connected through our online directory and volunteer opportunities, and get engaged with the passionate Mines community, wherever you may be. We are Mines!

Sincerely,
Paul C. Johnson, PhD
President and Professor
Colorado School of Mines

Ray Priestley '79
President, Board of Directors
Colorado School of Mines Alumni Association

Brian Winkelbauer
President and CEO
Colorado School of Mines Foundation



L to R: Paul C. Johnson, Ray Priestley, and Brian Winkelbauer

Mark Ramirez

AEROSPACE CHALLENGE

Mines Team Designs, Builds, and Flies at AIAA Competition

Each August, the American Institute of Aeronautics and Astronautics (AIAA) releases the new challenge for that year's Design/Build/Fly competition, in which students design, fabricate, and demonstrate the flight capabilities of a radio-controlled aircraft. This year, a group of Mines students was selected from 143 applicants as one of the 93 competing teams.

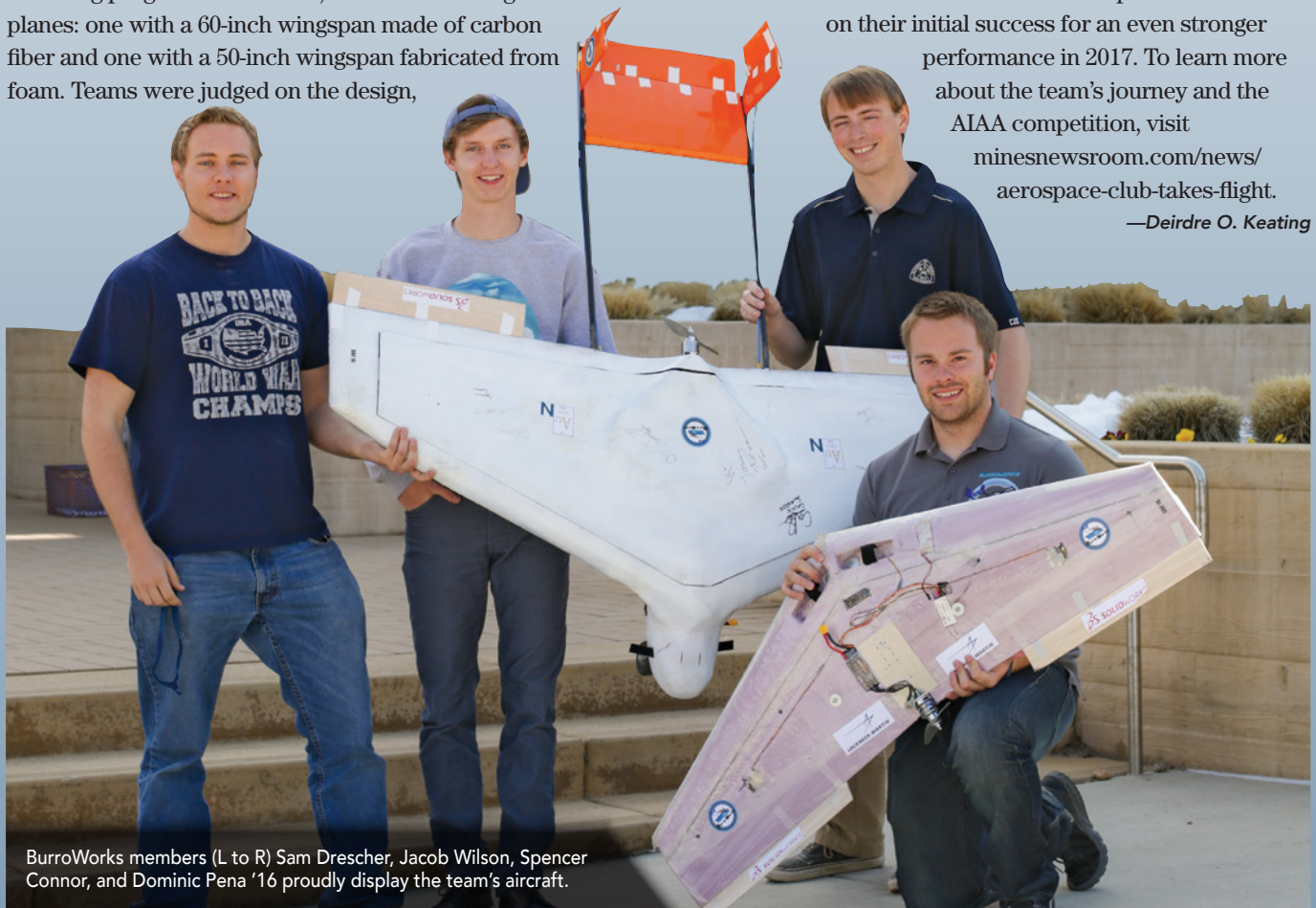
The 18-student team, called BurroWorks, progressed through various stages to participate in the final competition in Wichita, Kansas, on April 15-17, 2016. Using the computer-modeling program SolidWorks, the students designed two planes: one with a 60-inch wingspan made of carbon fiber and one with a 50-inch wingspan fabricated from foam. Teams were judged on the design,

manufacturing, and flight capabilities of their unmanned, electric-powered, radio-controlled aircrafts.

The Mines team finished in 19th place, edging out some big-name teams that have attended the competition for years. "We were ecstatic to finish as well as we did our first year," said team member Dominic Pena '16. "We placed higher than all the other Colorado schools—even out-of-state schools with strong aerospace programs like MIT, Purdue, and Berkeley. Just imagine what we could accomplish with more funding."

Next year's AIAA competition will be held in Tucson, Arizona. The BurroWorks team plans to build on their initial success for an even stronger performance in 2017. To learn more about the team's journey and the AIAA competition, visit minesnewsroom.com/news/aerospace-club-takes-flight.

—Deirdre O. Keating



Deirdre O. Keating

BurroWorks members (L to R) Sam Drescher, Jacob Wilson, Spencer Connor, and Dominic Pena '16 proudly display the team's aircraft.

FACULTY NEWS

GEOFF BRENNECKA RECEIVES NSF CAREER AWARD

Geoff Brennecka, assistant professor in metallurgical and materials engineering, received a National Science Foundation (NSF) CAREER Award to study how ferroelectric materials—crystalline materials with a built-in polarization that can be reversed under an electric field—respond to this stimulus at a more fundamental level. This polarization reversal, also known as ferroelectric switching, is well described at



Mark Ramirez

low speeds by classic equations. “But when we try to switch these materials extremely rapidly (e.g., in nanoseconds), their behavior becomes unpredictable,” says Brennecka.

The project, titled *SusChEM: Dynamic Defect Interactions in Ferroelectrics*, will receive \$458,000 over five years. It will be integrated into Brennecka’s efforts to expand student engagement, including participation in the annual Discover STEM Camp at Mines and establishment of a hot glass shop in Hill Hall. It will also fund a graduate student, who will be able to work for several weeks each year with collaborators in Virginia and Australia.

The NSF CAREER Award is the most prestigious award in support of junior faculty who exemplify the role of teacher-scholars through outstanding research, excellent education, and the integration of education and research within the context of the mission of their organizations.

Brennecka joined Mines in 2014 and is also a member of the Colorado Center for Advanced Ceramics faculty. He holds a bachelor’s and master’s degree in ceramic engineering from the University of Missouri-Rolla, and a PhD in materials science and engineering from the University of Illinois at Urbana-Champaign.

—Mark Ramirez

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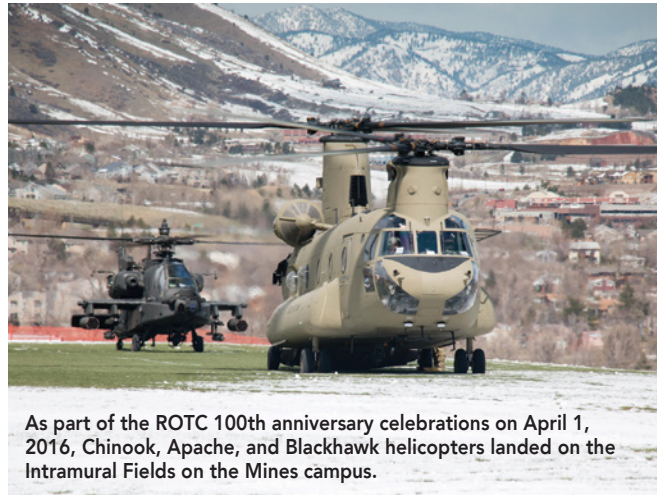
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ROTC AT MINES

Mines Celebrates ROTC 100th Anniversary

The year 2016 marks the 100th anniversary of the establishment of Army ROTC programs in the United States. Colorado School of Mines was designated the ROTC Company for the Battalion (13 metro area schools) to host the celebration, which included the following events that took place in conjunction with E-Days festivities on April 1.

- Cadets from Army ROTC Buffalo Battalion, joined by Air Force Cadets, conducted a three-mile run on the Mines campus.
- A series of cadet competitions and workshops were held on the Intramural Fields and in the Student Center ballrooms.
- Helicopters (featuring the Chinook, Apache, and Blackhawk) landed on the Intramural Fields, and pieces of



As part of the ROTC 100th anniversary celebrations on April 1, 2016, Chinook, Apache, and Blackhawk helicopters landed on the Intramural Fields on the Mines campus.

Agneta Bogucka

heavy-duty equipment were on display in Parking Lot D.

- President Paul C. Johnson and Major General Funkhouser spoke from the stage at Lot D. Following the speeches, Hugh W. Evans '49 and CPT Ryan Gibbons '09, MS '09 used sabers to cut the 100th "birthday" cake.

In 1919, with the War Department's authorization, Mines became one of the first four colleges in the United States to establish a reserve officers training

corps (ROTC). Since the program's inception, Mines has commissioned more than 2,400 officers for the U.S. Army. The Golden Buffalo Battalion received U.S. Army Cadet Command's MacArthur Award in 2013 and 2015, naming the Mines ROTC program as one of the top eight in the nation.

—Kathleen Morton



Support *Mines Magazine*

Mines magazine is mailed four times per year to more than 28,000 alumni and friends. We rely on donations from readers like you to help cover the ever-increasing costs associated with publication management, printing, and mailing. With your help, the Colorado School of Mines Alumni Association continues to bring you an editorially independent magazine, which means that readers' interests are the top priority when writing, editing, and producing the magazine.

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STUDENT SPOTLIGHT

A Passion for Stormwater Research

“This is *it*,” PhD student Chelsea Panos ’15 says when talking about how much she loves hydrology. “I didn’t discover hydrology until my senior year when I took hydrology lab, and then I was like, this is *really it*. Environmental engineering is cool, but this is where it is.”

Panos began her journey at Mines as an undergraduate student in the physics department before discovering her true passion: environmental engineering, and more specifically—hydrology. This passion earned her an Outstanding Graduating Senior Award at the end of her undergraduate career. “It was awesome to be recognized for all of the hard work I had put into four and a half years here,” she says. “That reception was definitely a highlight of graduation.”

But her journey at Mines didn’t end there; Panos immediately returned to pursue a PhD in the Hydrologic Science and Engineering (HSE) program, one of the top hydrology programs in the United States. Through this program, Panos was given the opportunity of a lifetime when the City and County of Denver approached Mines with a project related to stormwater modeling in the Berkeley neighborhood. Although she had previously participated in stormwater research in Los Angeles, when offered the chance to work in her own backyard, there was no way Panos could pass it up. “That’s the dream, to do what you love doing but in a place that’s home,” she says.

Denver’s Berkeley project looks at how infill development, or re-urbanization, impacts stormwater quality and quantity. The research focuses on the development of a stormwater-modeling tool for implementing Best Management Practices (BMPs) in re-urbanized areas using the EPA’s System for Urban Stormwater Treatment and Analysis IntegratioN (SUSTAIN) model. “One of the unique challenges we’re facing in Denver that we didn’t see in Los Angeles is a lack of data availability, so right now we’re collecting data within the basin,” Panos explains. “We’re installing our own sensors within the storm sewer network in the Berkeley neighborhood.”

Panos regularly goes out into the field to stream gauge and download the data to use in her model. “Sometimes I feel like a storm



Deirdre O. Keating

chaser, because when it rains, I get to go out there and collect my own data,” she says. “I know exactly where that data came from, I analyze it, and I then put it into my model.”

Her research is particularly important to Denver now, as the city continues to attract new residents. “The population of Denver is expected to increase by over 100,000 people in the next 10 years, so that’s really going to change how water is used,” Panos says. Stormwater could be a valuable resource to help offset some of this significant urban growth.

Panos also sees a need for similar research all across the West. “We were never supposed to build giant cities in the middle of deserts like Los Angeles, and people are realizing the potential for harnessing stormwater to help out these water-stressed areas and to increase water security,” she says. “Stormwater is this cool, untapped resource right now, and there’s so much research popping up to look into how we can use stormwater and treat it to increase both water quantity and quality.”

In recognition of her efforts on the Denver stormwater project, Panos recently received a National Science Foundation (NSF) Graduate Research Fellowship. The NSF program supports graduate students in STEM fields across the U.S., and Panos received one of 2,000 award offers selected from about 17,000 applications. She plans to use this award to help further her professional development and research goals.

Panos hopes to continue urban hydrology research in the future and share her knowledge with others. She says, “A lot of unique challenges arise from being in an urban area, and just the whole idea of bringing a part of nature back into the city is really cool.”

—Ashley Spurgeon

About Chelsea

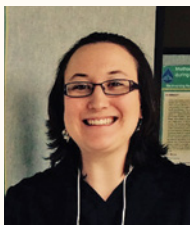
Hometown: Colorado Springs, Colo.

Favorite class: Hydrology Lab

Extracurricular Activities: President of Mines’ Society of Women Engineers (SWE) section

Three things she always has with her: My water bottle, my Order of the Engineer ring, and my passion

Dream Job: To be a research professor at Mines. I want to do research forever.



ATHLETICS

Orediggers Enjoy Historic Winter Season

Colorado School of Mines athletics enjoyed a phenomenally successful 2015-16. During the winter season, Oredigger teams won five RMAC regular-season championships and three RMAC Tournament titles—the most ever in a single year. The athletics program has also made a splash on the national scene, ranking third in the final winter Learfield Directors’ Cup standings, which measure the best overall programs in NCAA Division II.

WOMEN’S BASKETBALL

The women’s basketball program won its first RMAC Championship in 36 years after an improbable underdog season established the Orediggers as the league’s top team. Picked ninth in the pre-season coaches’ poll, Mines went 21-7 (including a program record 13-game win streak in mid-season) under RMAC Coach of the Year Brittany Simpson and all-RMAC selections Courtney Martin, Laura Tyree, and Anna Kollmorgen. The team advanced to the NCAA Tournament for only the second time in its history.



RMAC Player of the Year Gokul Natesan led Mines men’s basketball to its sixth MCAA Tournament appearance in seven years.

Tim Flynn

MEN’S BASKETBALL

The men’s basketball team put together its third consecutive 20-win season, going 24-8 and earning a runner-up finish in the RMAC Tournament, along with its sixth NCAA Tournament berth in the last seven years. RMAC Defensive Player of the Year and First-Team Academic All-American Gokul Natesan led a high-scoring Oredigger team that won 10 straight games to end the regular season.



Leah Pinkus

The Mines women’s basketball team won its first RMAC regular-season championship since 1980, led by RMAC coach of the year Brittany Simpson.

MEN’S AND WOMEN’S SWIMMING

Junior Carrie Kralovec became the first Mines female swimmer to qualify for NCAA Championships since 2010, capping a record-breaking season by appearing in the 100-, 200-, and 500-free. The Mines men finished fourth at RMAC Championships, while the women took fifth.

MEN’S AND WOMEN’S INDOOR TRACK & FIELD

It was an historic indoor season for Mines track & field, as the men clinched their first RMAC Indoor Championship on February 27, 2016. RMAC Coach of the Year Matt Sparks orchestrated a come-from-behind win thanks to four individual champions. At NCAA Indoor Championships, Mines earned seven all-Americans, including two awards for senior Marty Andrie in the 3,000-meter run and the distance medley relay. The Mines women placed seventh at RMAC Championships and qualified their distance medley relay to nationals.

WRESTLING

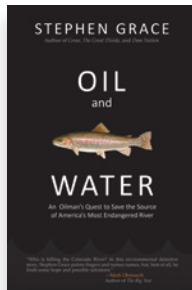
The Mines wrestling team produced its best dual meet record since 1960, going 8-6 overall including the best start to a season ever. Senior 197-pounder Paul Wilson won the RMAC and NCAA Super Regional championships to end the season ranked first in the nation at his weight class.

—Tim Flynn

For more on Mines athletics, visit minesathletics.com

BOOKS

Just Published



Oil and Water: An Oilman's Quest to Save the Source of America's Most Endangered River

Bud Isaacs '64 joined forces with environmental author Stephen Grace to tell the story of the Colorado River headwaters, a resource under siege. For 15 years, Isaacs—who earned his degree in petroleum

engineering at Mines—has blown the whistle on an abused stretch of the American West's most iconic river: the Colorado. In telling the story of Isaacs' battle to repair the ecological damage caused by more than a century of water development, Stephen Grace was forced to confront the complicated currents that connect us all to water and energy. *Oil and Water* highlights the importance of healthy watersheds and reveals the struggle to save the source of the Colorado River. Seventy-five percent of the book's proceeds will go to the Upper Colorado River Alliance, a nonprofit organization dedicated to protecting and restoring the upper Colorado River watershed. (Upper Colorado River Alliance, 2016)



Relentless Forward Momentum

Matthew R. Harris '09 has authored a new book titled *Relentless Forward Momentum*. The book outlines a six-step formula used by bestselling authors, professional athletes, Navy SEALs, and nationally ranked salespeople to help readers develop a

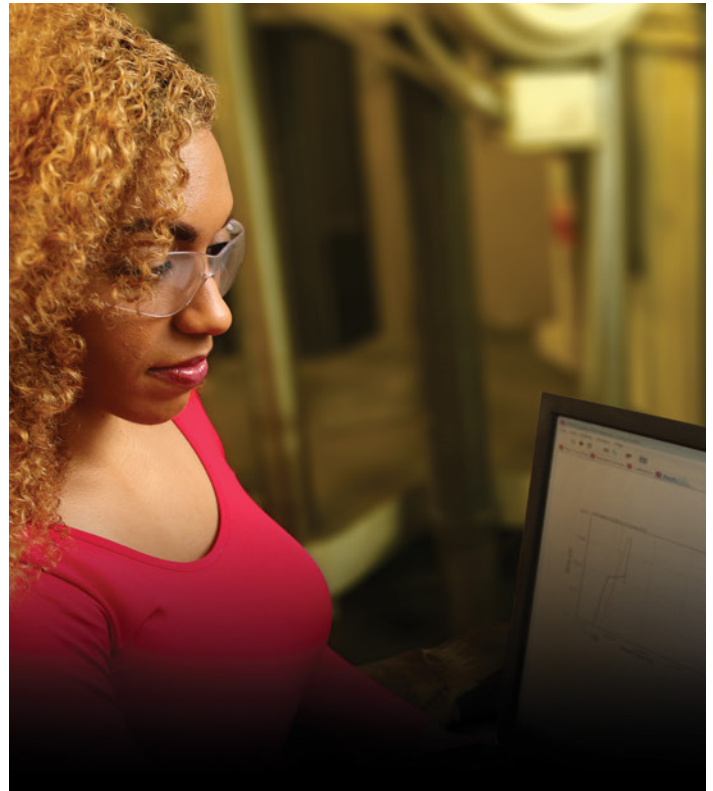
crystal-clear vision, master habits, become fearless, attract abundance, and build a powerful team to make success a certainty. (Matthew R. Harris, 2016)



Federal Innovation: You and New Agriculture

Francis "Frank" Wolek '57 is the author of the recently published *Federal Innovation: You and New Agriculture*. The book discusses the USDA's Agricultural Research Service (ARS) and how innovative communities in agriculture unite processors, farmers, and

government agencies. Wolek explains how this system works and outlines how to make it more successful. (CreateSpace Independent Publishing Platform, 2015)



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H₂O 2020

With water shortages looming for Colorado, Mines researchers think outside the box for solutions

By Lisa Marshall



Try to picture Colorado's water situation 30 years from now, and you'll likely conjure images of brown lawns, wilting crops, and dry creek beds where anglers and kayakers once played. With the state's population projected to double by 2050, the Colorado River Basin already experiencing the lowest flows in a century, and the state projecting a 181-billion gallon annual water shortfall by mid-century, it's easy to imagine a bleak future.

But John McCray sees it differently. The Mines professor of civil and environmental engineering envisions a future in which everything from hydraulic fracturing water (frack water) to toilet water is cleaned up and re-used—the solid “waste products” recycled into fertilizer for crops or fuel to

power water treatment plants. Rather than the customary practice of shipping water in from hundreds of miles away, using it once, then discarding it, communities will collect, treat, use, re-use, and store more local water, which often leaks out or evaporates in transit. Meanwhile, developers will routinely design neighborhoods to catch stormwater for irrigating parks and golf courses.

“I'm not worried,” says McCray, principal investigator for the Mines-based Engineering Research Center for Re-Inventing the Nation's Urban Water Infrastructure (ReNUWIt). “We'll just have to start using water smarter, and some of the policies that have made it difficult for us to do so will have to be revised. You're already starting to see it happen.”

McCray is among dozens of researchers, students, and alumni working to put Mines on the map as a hub of innovative solutions to the West's looming water crisis. With roughly 55 graduate students, Mines' Hydrologic Science and Engineering (HSE) program is among the top hydrology programs in the nation. The 10-year NSF-funded ReNUWIt program (a collaboration with three other universities) is churning out ideas on how to improve the country's aging urban water systems. At the ConocoPhillips Center for a Sustainable WE²ST (Water-Energy Education, Science and Technology), graduate students are exploring how to best reclaim water from oil and gas sites.

As McCray puts it, "We have strength in numbers here."

Long Road, New Map

Colorado's water woes date back to 1922, when the Colorado River Compact spelled out how much water originating in the state had to be shared with downstream neighbors. The Upper Basin states (Colorado, Utah, Wyoming, and New Mexico) and the Lower Basin states (California, Arizona, and Nevada) each lay claim to 7.5 million acre-feet per year in perpetuity (one acre-foot is enough water to cover a football field at a depth of one foot). According to the terms of the compact, Colorado received rights to 51 percent of the Upper Basin share. Eight subsequent compacts did the same for other rivers originating in the Rocky Mountains.

The problem: "They happened to do this during one of the wettest periods in history," explains McCray. As a result, more water has been allocated than actually exists in the river today. "If everyone downstream decides to use their water rights at the same time, that will be a problem."

Population growth and climate change are also at play. Colorado's population soared from 1 million in 1930 to 5 million today and could hit 9.2 million by 2050, according to state

agencies. Higher, dryer days are expected to boost water demand by as much as 8 percent. Meanwhile, frequent forest fires and windy "dust on snow" events also impair supply. By 2050, the state could be short 560,000 acre-feet of water annually for municipal and industrial needs.

With all this in mind, in November 2015 the Colorado Water Conservation Board (the agency tasked with protecting and developing state water sources) unveiled the first-ever state water plan, a 400-page tome designed to bring stakeholders together to fend off the impending shortfall. "We didn't just speak on the 50,000-foot level," says Rebecca Mitchell '02, MS '07, the state's section chief for water supply planning, who helped write the plan. "We set a specific goal and the actions that needed to happen to support that goal. That was a huge step forward."

While 89 percent of water in the state goes to agriculture, much of the plan is focused on the 11 percent used by homeowners and industry. The plan aims to reduce the projected gap from 560,000 acre-feet to zero acre-feet by 2030. To do that, it aims to save 400,000 acre-feet via conservation. But the plan also makes a strong call for more water re-use and better planning, declaring that "by 2025, about 75 percent of Coloradans will live in communities that have incorporated water-saving actions into their land-use planning."

"We didn't want easily achievable goals. We wanted stretch goals," says Mitchell. "We wanted to create an environment where people would be pushing on technology and knocking on the door with innovative solutions." That's where Mines comes in.

From Toilet to Tap

In 2008, Mines unveiled its own state-of-the-art wastewater reclamation facility on a one-acre plot at the edge of campus, to serve as a model for how small, decentralized treatment plants can turn even the nastiest wastewater into liquid gold for local

L to R: Terri Hogue, Jackie Randell, Chelsea Panos, and Lisa Cherry install a stilling well at the inlet of Berkeley Lake in Denver. Water levels are measured every five minutes and converted to flow to quantify how much stormwater runoff enters the lake over time.



Kathryn Lowe



U.S. Department of the Interior-Bureau of Reclamation/Andrew Pernick



U.S. Department of the Interior-Bureau of Reclamation/Alexander Stephens

The top image, taken in March 1998, shows Lake Mead's water level behind the spillway at Hoover Dam at 1,196 feet. By June 2015, Lake Mead's elevation had dropped dramatically to 1,075 feet (bottom image), a decline of 121 feet.

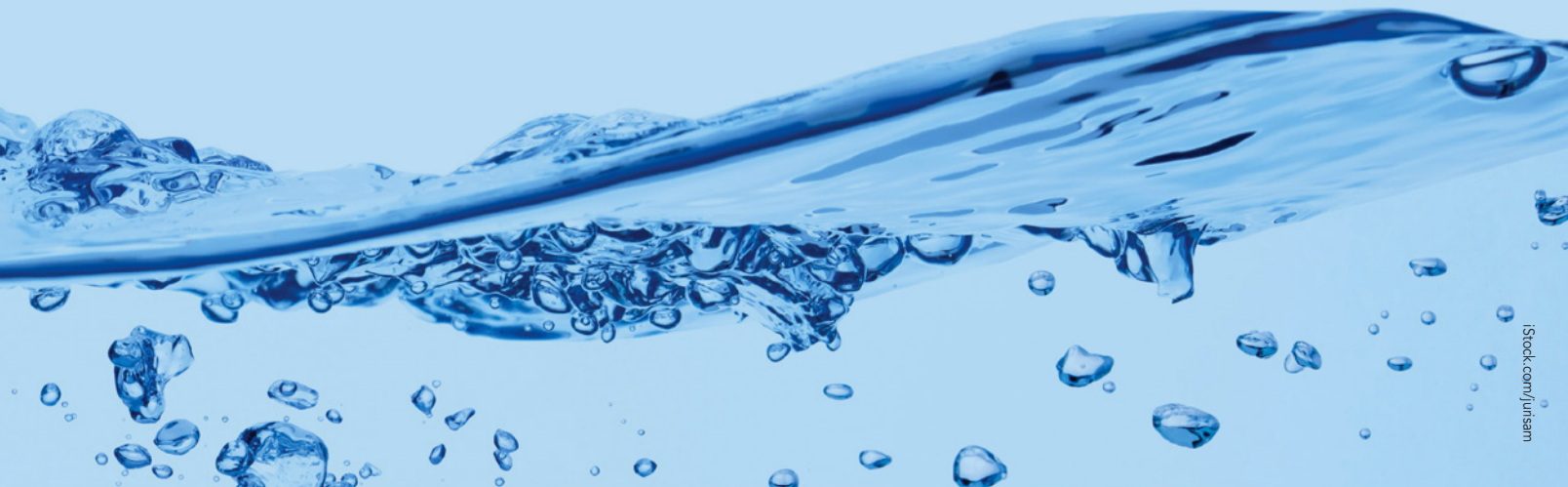
“The technology exists to take any kind of water—frack water from oil and gas, student waste water, industrial waste—and turn it into drinking water.”

—Professor Tzahi Cath

use. Today, the plant uses a sequence of biological and physical processes to treat 7,000 gallons of water daily from the Mines Park student housing facility. Using a method called “tailored treatment,” the facility varies the degree to which it purifies water, depending on what it’s used for. For instance, in the summer, when the water is used for irrigating turf grass, some fertilizing nitrogen may be left in. In the winter, when more water is released downstream, it might be treated with reverse osmosis for higher quality. Some water is diverted into an experimental greenhouse, and some is used to grow energy-producing algae in ponds.

By treating the water only to the degree it needs to be treated (rather than watering lawns with near-potable water), money is saved and “waste” is transformed into a valuable resource, says Professor Tzahi Cath, professor and director for the Advanced Water Technology Center (AQWATEC) at Mines. The center is now looking at ways to make small satellite centers like this economically feasible on a broader scale. “How do we reduce the cost of treatment so that each neighborhood can have its own wastewater treatment plant, operate it autonomously, and reuse the water locally? This is the big question,” says Cath.

While Mines Park water is not currently transformed into drinking water, a third step could easily make it happen. “The technology exists to take any kind of water—frack water from oil and gas, student waste water, industrial waste—and turn it into drinking water,” says Cath.





Courtesy of Denver Water

This billboard from Denver Water's 2011 "Use Only What You Need" campaign employed a strong visual to encourage Denver residents to conserve water.

In 2015, a number of drought-parched Texas communities began drinking so-called "toilet-to-tap" or "direct potable reuse" (DPR) water. Unlike most potable water, which is typically cleaned to a degree, passed through an environmental buffer like an aquifer or reservoir, then cleaned again, DPR water is taken from its original form of wastewater all the way to drinking water in one place. That saves money and water—but it's a hard sell. "Only when the knife gets very close to the throat are people willing to talk about direct potable re-use," says Cath.

That day hasn't come yet for Colorado. But already, some agencies are working to expand their water re-use for industrial applications or irrigation. Denver Water already delivers two billion gallons of reclaimed water to Front Range parks and industrial customers and is making a concerted effort to boost that number, says Sarah Dominick '03, MS '05, who heads up Denver Water's Integrated Resource Plan for meeting future water needs. "Our goal is to plan across the entire system so we are not just looking at supply and demand, but also at treatment plants and distribution systems and recycling systems and how all of that fits together," she says. "We are taking a more holistic view of the water cycle."

Saving Stormwater

Another key piece of that holistic view is something that, until recently, hadn't been a part of the dialogue: stormwater.

"For years, stormwater was thought of as waste—something we have to deal with and get out of the city," says Professor Terri Hogue, director of the Mines HSE Program. "Now we are totally rethinking the engineering on that and realizing it can be another source of water supply."

Mines recently received a \$2.6 million Environmental Protection Agency grant to develop a decision support tool for government agencies or housing developers interested in developing novel infrastructures to make better use of stormwater.

This year, researchers also embarked on a collaboration with the City and County of Denver to explore how proactive stormwater planning could impact the booming two-square-mile Berkeley neighborhood in Denver. With 8,000 residents, the neighborhood is expected to grow exponentially, as developers knock down single-family homes and replace them with



Stock.com/schulze

The recent passage of HB 16-1005 in Colorado now permits homeowners to collect some rainwater for household use.



Deirdre O. Keating

Graduate student Tori Frank explains the study she conducted for her master's thesis to Mines president Paul C. Johnson in the AQWATEC Laboratory at Mines Park.

multi-unit condos. With fewer grassy lawns to soak up water, more—and dirtier—wastewater is expected to make its way downstream. Instead, Hogue, McCray, and a group of students are crafting a plan to divert that wastewater to the Willis Case Golf Course (which is currently watered with potable water). There, green infrastructure would treat it so that it can be used for irrigation.

“We are not only taking the water and treating it; we’re also putting it to beneficial use,” says Chelsea Panos ’15, a Mines hydrology PhD student working on computer models for the project.

Data-Driven Conservation

No discussion of Colorado’s water shortage solutions would be complete without talking about conservation. Statewide, according to the Colorado Water Plan, municipalities have already reduced their per-capita use by 20 percent in the past decade via voluntary and mandatory restrictions, tiered-rate structures (where customers pay more if they use more than a base amount of water), and educational initiatives.


But not all conservation initiatives work as well as others. In an effort to help municipalities understand what works best, Hogue and her students have conducted an array of usage studies in both California and Colorado.

In one recent study of Los Angeles water use patterns, she discovered several key things: Wealthier neighborhoods used

three times as much water as less affluent ones; outdoor water use accounted for 54 percent of consumption; and mandatory restrictions led to a 23 percent reduction in use, while voluntary ones cut water use by only 6 percent.

Some takeaway lessons: There’s a lot to gain by limiting outdoor water usage, and some large-volume consumers “insensitive to current pricing structures” may need to be charged even more or have their volume restricted. “There also needs to be more dual metering in urban centers—indoor and outdoor water meters—so folks are charged higher rates for excessive outdoor use,” says Hogue.

To retain additional conserved water for future use, Denver Water and other agencies are also exploring new storage options, like underground aquifers or small off-stream reservoirs. Meanwhile, the recent passage of HB 16-1005 (which allows homeowners to collect some rainwater for home use) has sparked optimism that lawmakers might be growing more amenable to tinkering with some of Colorado’s archaic water laws—in the name of conservation.

Most importantly, stakeholders from various agencies say they are, more than ever in the past, working together on solutions they might not be able to achieve alone. “I think it is a really exciting time to be in water,” says Denver Water’s Dominick. “There is a new collaborative spirit among water agencies and partners and other water users. While the challenges are very large, I think we can find the solutions.” 

Large urban areas in the arid West, like metro Denver, have rapidly growing populations that place increasing demands on water supplies.



We are MINES

**As Graduate Needs Evolve,
Mines' Alumni Association
is Reinventing Itself**

By Lisa Marshall



Having missed out on the tradition during his freshman year at Mines, Ed May '65 (far right) joined incoming students in the 2015 M Climb.

As Ray Priestley '79 left the Green Center auditorium on graduation day back in 1979, he clutched his shiny silver diploma tightly and had a thought shared by many of his fellow graduates that day: Get out fast, and don't look back.

"The thought at the time was, 'You don't want to stick around too long, or they might take your degree back,'" jokes Priestley, recalling a grueling academic schedule, little time for extracurricular activities, and an intimidating faculty and administration. Just a few days after graduation, he left for a job in Oklahoma, didn't step foot on campus for years, and didn't find his way to the Mines Alumni Association (CSMAA) for decades. "For a while I didn't stay connected, and I didn't think that much about what got me to where I am," admits Priestley, now president of the CSMAA Board of Directors. "Honestly, I took Mines for granted."

Fast forward to today, and the face of Mines alumni is changing radically, with many grads—eager to network in a tight job market and stay in touch with the newly enriched campus life—reaching out to their fellow alumni the day they graduate. More than 60 percent of Mines' 26,000 alumni are now under the age of 40, and about a quarter of graduates are women. Many hail from other countries. And many turn to Facebook or Twitter to keep tabs daily on their alma mater and those who attended, rather than stay in touch via the occasional reunion cocktail hour.

To better cater to this new generation, and to operate more efficiently in an era of tight budgets, the 120-year-old CSMAA is, like many alumni associations nationwide, reinventing itself. As of July 1, 2016, the association no longer requires alumni to pay membership dues. Instead, every Mines graduate will become a member automatically: no dues required.

Alumni staff have been restructured too, with the editorial staff of *Mines* magazine and a soon-to-be-hired Executive Director of the Mines Alumni Association employed by the school, and the remaining CSMAA staff employed by the Mines Foundation. Most importantly, the association is rolling out a host of new offerings, from mentorship programs that match current students with alumni in their fields, to Interest Groups that enable alumni, students, and

faculty to connect based on an area of common interest.

"Thirty or 40 years ago people would graduate, not want anything to do with Mines for 10 years, then slowly find their way back. The younger alumni want to be connected as soon as they walk out the door," says Mines president Paul C. Johnson. "These changes will help the alumni association focus on what it's most excited about: engaging with those students and alumni."

A New Era for Alumni Associations

CSMAA is among a growing number of alumni associations nationwide having to retool in the face of changing alumni demands. "In general, alumni associations are becoming dinosaurs," says higher-education fundraising consultant Jack Miller, of the Fort-Collins based Miller Group. "They will continue to be out there, but in order to succeed they will have to be in a different form."

Miller says the millennial generation (born between the 1980s and 2000) is generally less interested in joining formal groups and less willing to pay annual fees. And with the rise of social media, they can stay in touch with college peers without joining an alumni association. "They don't need alumni reunions as much because they have a reunion every day on Facebook with the people they care about." To address these changing demands, he says, alumni associations must bolster their social media presence and give their young alumni



The Mines music program provides an opportunity for students and alumni to travel and perform together in international locations. In the image above, Catherine Skokan '70, MS '72, PhD '75 poses with Marv the Miner while the Mines Marching Band prepares for their march in the 2016 St. Patrick's Day parade in Dublin.

Dennis Richards

“The younger alumni want to be connected as soon as they walk out the door. These changes will help the alumni association focus on what it’s most excited about: engaging with those students and alumni.”

— Paul C. Johnson, Mines president and professor

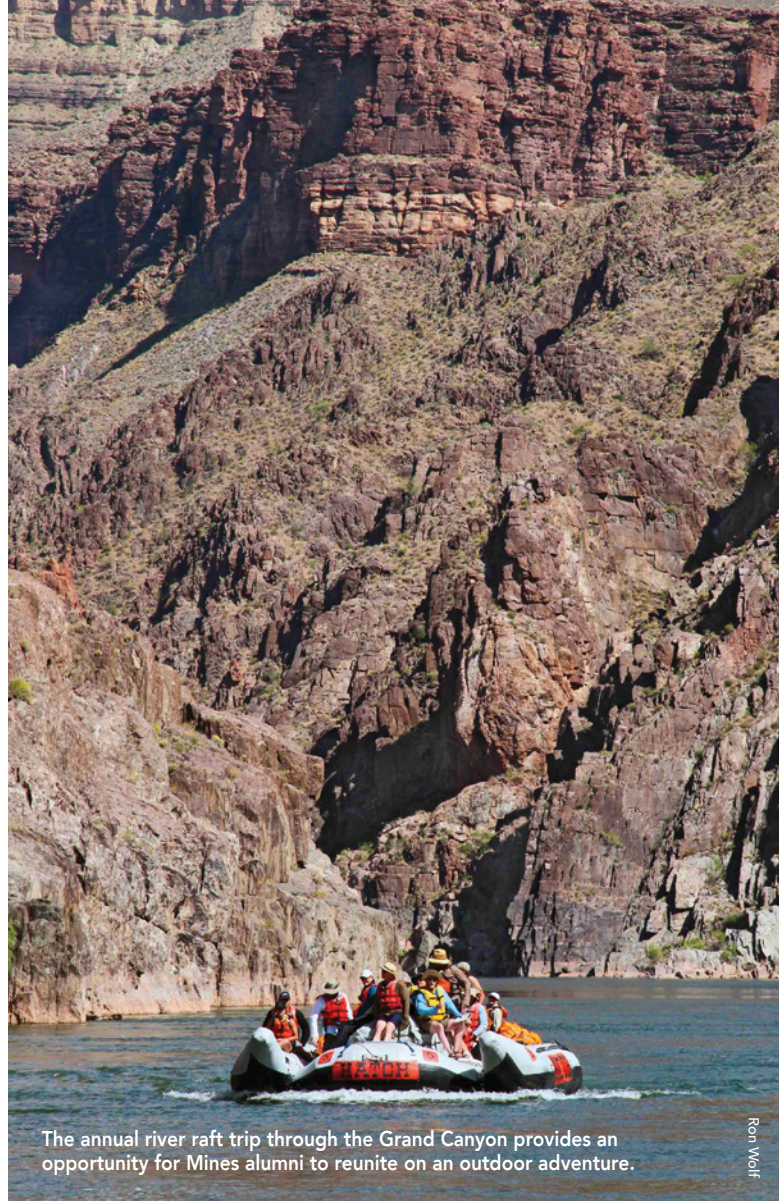
frequent opportunities for professional networking and career development.

Mines is doing just that, initiating four new interest groups—Corporate Social Responsibility, McBride Honors Alumni, Mines Music Alumni, and Women at Mines—to enable alumni to connect around a common interest. CSMAA will also bolster support for and expand its 55 sections (now called M Clubs) around the country and world.

“Mines is constantly changing and evolving. We want to use the M Clubs as platforms to re-engage and update alumni on how they can be involved in what’s happening and empower them to be ambassadors for the school,” says Janet Preloger, assistant vice president of constituent relations for the foundation.

Historically, most alumni associations operated as independent nonprofits, with their own budget and staff and funded primarily via dues with a little help from the university they served. But as annual dues have become challenging for associations to collect, many cash-starved alumni groups have merged with their school or foundation. According to a 2016 survey of nearly 500 U.S. schools by market research firm Alumni Access, 68 percent of alumni associations are now fully integrated with their school’s fundraising and development departments, and 74 percent now have no-dues models.

Mines is now part of that trend. Under the new no-dues model, its membership will automatically increase from 6,188 to more than 26,000. Its new partners at the school and foundation will cover its budget and handle many of the association’s administrative tasks, like accounting and human resources. “Without having to shoulder that responsibility, we can focus on connecting people more to each other and to the school,” says CSMAA board member Aprill Nelson ’08.



The annual river raft trip through the Grand Canyon provides an opportunity for Mines alumni to reunite on an outdoor adventure.

Ron Wolf

What Young Alumni Want

When Nelson arrived on campus as a student in 2004 to participate in the McBride Honors Program, she was nervous about leaving her family back in Houston. But within months she felt at home. “Mines became a second family to me,” she says. Before she even donned her cap and gown in 2008, she donated \$1,000 and became a lifetime member of CSMAA. One year ago, she joined CSMAA’s Board, offering the perspective of a young, African-American female familiar with the realities of today’s job market.

“It used to be that you would start with a company and be there for 20 years. Now, it is maybe three to five years. You move around a lot more,” says Nelson, who has worked with Scotiabank and Swift Engineering as a reservoir engineer and is currently between jobs. “Having the opportunity to chat with alumni who have been around and are more seasoned can be hugely helpful.”

Kim (Tony) Hyung, a senior at Mines, agrees and is working to create more opportunities for young Mines alumni to share their wisdom not only with fellow alumni, but also with current



Laurie Schmidt

The Mines Alumni Association occupied the Coolbaugh House on campus from 2010 to 2015, when it moved into the new Starzer Welcome Center.



Amy Schneider

Mines alumni from the Kuala Lumpur M Club celebrate E-Days 'Round the World.

NEW PROGRAMS

INTEREST GROUPS

Interest Groups provide a new opportunity to connect with alumni, faculty, and students based on a specific area of interest. Each group has a student engagement component, creating more ways to interact with the Mines community. The core groups of our pilot year include Corporate Social Responsibility, McBride Honors Alumni, Mines Music Alumni, and Women at Mines, with plans to expand in the future.

ALUMNI DISCOVERY LABS

Your feedback is critical to the future of our alumni programs. Participate in an Alumni Discovery Lab, an interactive opportunity to share feedback about your alumni experience and help us shape future plans. Stay tuned for dates and locations.

ENHANCED PROGRAMS

M Clubs (formerly called Sections)

No matter where you live, be part of the extended Mines family. Join an M Club near you to participate in a variety of networking events, from Send-Off Parties to E-Days 'Round the World.

Online Alumni Directory

All alumni now have access to the Online Alumni Directory, a powerful networking tool that enables you to search for fellow Orediggers through a variety of categories. Use the directory to sign up for Interest Groups, volunteer opportunities, and more.

To learn more visit minesalumni.com/WeAreMines.

students. During his sophomore year, Hyung was struggling with self-doubt and contemplating a switch from petroleum engineering—his lifelong dream—to mechanical engineering. One evening he heard Priestley, a petroleum engineer, speak at a networking event and cornered him afterward to ask him what his career had been like. “He told me he had struggled at times, too, but that if I was passionate about it, I should stick with it. If I hadn’t talked to him that day, I would be in a really different position right now,” Hyung says.


Hyung, current president of the Student Alumni Association, is now working with CSMAA to craft a pilot mentorship program, which will formally match current students with select alumni mentors, starting this fall. Hyung would also like to see alumni of all ages gather in person with students for social functions.

President Johnson shares that vision. “Most of the engagement with the alumni association has historically been on the front end, in terms of send-off-parties as students head off to Mines, or years later as the alumni association catches them after they graduate” he says. “I would love to see more alumni engagement with students while they are here.”

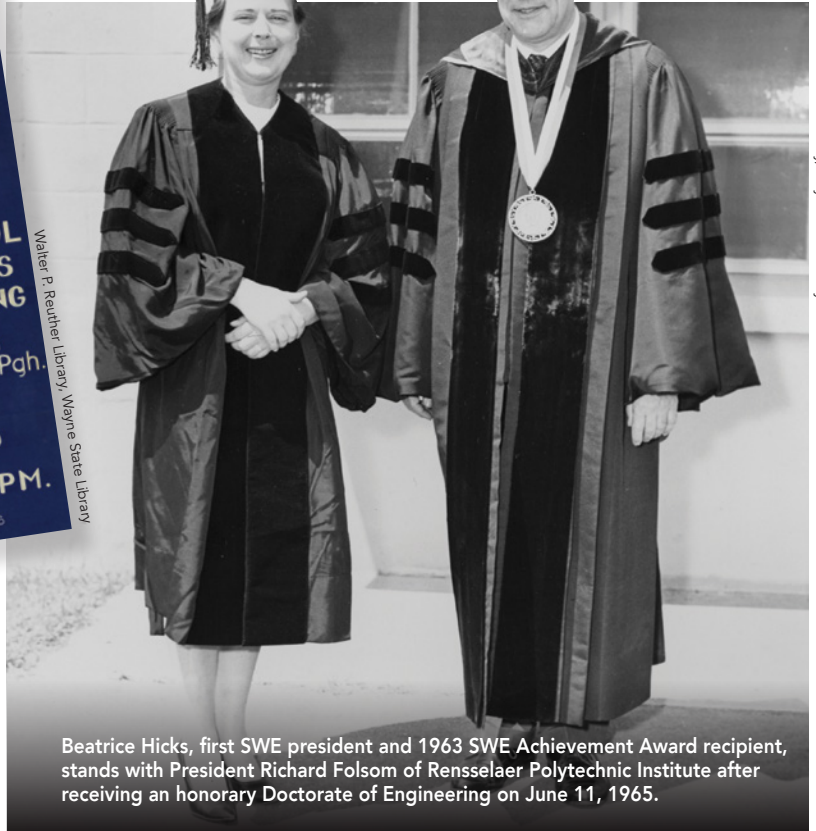
Big Changes, Bright Future

CSMAA board members involved in hashing out the details of the transition concede that the merging of the alumni association with the school and foundation has not been without hurdles. When the idea of joining forces emerged, it was met with opposition by some long-time alumni. “This is a huge change, and there has been a contingent that is averse to it,” says Cooper Swenson '04, a former board member. Swenson noted that even one year ago, he was opposed to the merger, but he has since changed his mind.

Under the plan they came up with, CSMAA remains an independent 501(c)(3) nonprofit with its own clear mission (i.e., to engage with students and alumni). Meanwhile, the alumni association will continue to have significant oversight of *Mines* magazine through the editorial board. “I feel like when we finally all shook hands, it was a huge success,” says Swenson.

Priestley agrees. “Transitions are never easy, but now we can really see momentum building,” he says. “We have this amazing opportunity to expand the alumni network and do great things now. It’s an exciting time for Mines alumni and for Mines.” 

LOOKING BACK



Beatrice Hicks, first SWE president and 1963 SWE Achievement Award recipient, stands with President Richard Folsom of Rensselaer Polytechnic Institute after receiving an honorary Doctorate of Engineering on June 11, 1965.

SWE Can Do It

How the Society of Women Engineers Helped Change the Face of Engineering

“The primary obstacle that women face in engineering is the perception of what an engineer is and what an engineer should be,” says Karen Horting, executive director and CEO of the Society of Women Engineers (SWE). In 1919, three female engineering students from the University of Colorado took action to overcome this obstacle by creating their own professional engineering society: the American Society of Women Engineers and Architects (ASWEA).

ASWEA identified only 139 women nationally who took collegiate courses in engineering. Because of this small number, ASWEA founders saw the need for an organization that “stimulates women to achieve their full potential in careers as engineers and leaders, expands the image of the engineering profession as a positive force in improving the quality of life, and demonstrates the value of diversity.” This became the mission statement for SWE, founded by Hilda Counts Edgecomb and 60 other women 30 years after ASWEA’s inception.

ESTABLISHING A NETWORK OF SOLIDARITY

To help build a support network for female engineers, SWE hosted its first national conference in 1951 in New York City. According to co-founder Betty Lou Bailey, SWE members attended the conference to network and bypass the human resources department, which would automatically put women’s résumés in the trash. The annual conference is one of SWE’s most enduring accomplishments.

Colleen Layman, SWE’s current president, believes the

organization’s most significant recent achievements are in public policy, which became a focus in 1994. “We’ve used Title IX as a focus to help drive gender equity in education in the engineering space,” she says. “SWE has really become the voice for women in engineering on Capitol Hill.”

Eight years ago, SWE initiated annual visits to Capitol Hill to promote legislation connected to SWE’s mission. “Our future focus will include a push for more work-life balance and more family-friendly benefits and policies,” says Jan Williams, chair of the SWE Government Relations and Public Policy Committee. “While strides have been made, we are still far from gender equity, and the problem with retention of women in the engineering workforce continues.” Despite these challenges, however, the workforce numbers are improving: when SWE was founded, less than 1 percent of U.S. engineers were female; that number rose to 5.8 percent in 1983 and to 12.7 percent in 2010.

BRINGING SWE TO MINES

The Mines collegiate SWE section was founded in 1968 with five students and Anita Peil ’71 as its president. Members met to develop professionally and personally, inviting working engineers to give presentations. Louise Wildeman, the SWE faculty advisor in the 1990s, oversaw dramatic membership growth and the creation of many of the annual events still taking place today. Then, in the early 2000s, Deb Lasich, the current Associate Vice President of

SWE TIMELINE

1919

Female engineers at University of Colorado Boulder create the American Society of Women Engineers and Architects (ASWEA)

1950

The Society of Women Engineers (SWE) is founded during a two-day meeting in New Jersey

1968

Mines collegiate SWE section is formed with five members

1992

Mines SWE hosts its first Back-to-School Pizza Party as a recruitment tool, which leads to a record-breaking 122 members

1993

Mines SWE holds its first Evening with Industry event

1998

Mines SWE launches Girl Scout Badge Day (known today as Girl Scout Engineering Day)

1999

Mines SWE starts the Continuum to honor graduating females

2008

SWE begins Capitol Hill visits to advocate for women in STEM

2016

Mines Alumni Association, Admissions, WISEM, and SWE form the Women at Mines interest group



Agata Dean

Fourth grader Emilia Miodonski shows off the lava lamp she made at Girl Scout Engineering Day.

Diversity and Inclusion, and Candace Sulzbach '81, a SWE faculty advisor, focused on strengthening the organization at Mines, from its leadership structure and training, to its corporate sponsorship and financial management.

Today, Mines SWE has 721 members, making it the largest collegiate SWE section in the nation and the largest professional organization at Mines. But Lasich emphasizes that the success of Mines SWE has been a group effort. "From the beginning, we knew it was important to build partnerships with decision makers and key personnel in Academic Affairs, Student Life, Admissions, Career Services, Institutional Advancement, and the Engineering Division," she says. "Our goal was to make SWE one of the 'jewels in the Mines crown' and to also make a positive impact on the Mines culture regarding diversity and inclusion."

SWE members meet weekly, usually filling Friedhoff Hall in the Green Center to capacity. But SWE's hallmark event at Mines is the annual Evening with Industry, where members network with recruiters and alumni on the eve of the fall campus career fair. The 23rd annual event, held in September 2015, hosted a record 320 attendees. "We are devoted to helping our members grow professionally so that when they go into the workplace, they will be prepared to extinguish stereotypes and confidently take on leadership roles," says Stephanie Berry MS '16, director of the Women in Science, Engineering & Mathematics (WISEM) program at Mines.

In addition to campus events, Mines SWE commits itself to

community outreach through a partnership with Girls Scouts of Colorado. Since 1998, SWE has invited 5th and 6th grade Girl Scouts to campus each year to learn about science and engineering. "There have been several girls who participated in Girl Scout Engineering Day as 5th or 6th graders and then went on to come to Mines and graduate with an engineering degree," says current SWE faculty advisor Agata Dean '04, MS '06.

SWE also hosts the annual Girls Lead the Way conference to engage with high school girls. "It was never clear to me what an engineer does," says Sophia Becker, a recent high school graduate who plans to pursue engineering. "It was Girls Lead the Way that offered a more substantial definition: people who change the world." In 2015, SWE launched yet another outreach program, this one aimed at middle school girls, called Energy Leaders Making a Difference.

But the work is not finished. To continue to address the challenges faced by women engineers, Norma Mozeé '83, a member of the Mines Alumni Association Board of Directors, initiated the new Women at Mines interest group. "It's an exciting opportunity to shape the future for women and to make a relevant and positive impact on the lives of women," she says.

—Emily Gonzales '08



To learn more about the Women at Mines interest group, visit minesalumni.com/womenatmines. For information about the 2016 SWE conference, visit we16.swe.org.

ALUMNI NETWORK

LUCK OF THE IRISH

Mines Digs Dublin

It's the stuff bucket lists are made of. Travel to Dublin—check. Travel to Dublin for St. Patrick's Day—check, check. Travel to Dublin for St. Patrick's Day *and* march in the St. Patrick's Day parade—check, check, check.

Mines musical engineers hit the road in March for the trip of a lifetime to Dublin, Ireland. Musicians from the marching band, orchestra, and choir, accompanied by supporting alumni, faculty, and friends, made a musical journey to the Emerald Isle, with the St. Patrick's Day parade being only one of many trip highlights.

Day one began with a Dublin City bus tour, which featured O'Connell Street's historic monuments and a glimpse of the Old Parliament building. This inside look at Dublin's rich history also included a visit to Trinity College and its renowned library, home of the Book of Kells. Typically, students wouldn't set foot in a library during Spring Break, but this was a memorable experience for all participants. "There was so much to learn about the history of Ireland and its people," says Ray Priestley '79, president of the Mines Alumni Association Board of Directors, who traveled with the group.

The Mines group visited the Dublin Institute of Technology (DIT), where they were treated by the hosts to an educational and entertaining lecture. "Mark Deegan, the head of apprenticeship and engagement at DIT, was so impressed by the knowledge, interest, and open minds of his guests that he cancelled his afternoon commitments and personally led our afternoon tour of the Hill of Tara," says Priestley. "He looks forward to growing the connection to new friends at Mines."



Matthew Ladwig

Erica (Kellenberger) Ladwig '14 plays the flute on the campus of the Dublin Technological Institute, where the Mines marching band practiced marching with design and engineering students.

Day two included a concert tour through Waterford, Ireland, beginning with a performance by Mines' orchestra and choir at Sacred Heart Parish. Next stops included a tour through the Waterford Crystal Factory and an afternoon concert at the Church of Ireland Cathedral at the city's Cathedral Square, featuring spiritual music of the United States.

Mines musicians—and even some of the less musically inclined parents and alumni—had an opportunity to experience traditional Irish music at Waltons New School of Music, where they participated in whistle lessons, an introduction to the uilleann pipes (the national bagpipes of Ireland), and fiddle lessons. The day wrapped up with a musical pub crawl, featuring local Irish musicians who told stories and shared their culture through song.



Ray Priestley

Mines student Lauren Badger and other members of the Mines marching band participated in a cooking class at the Cooks Academy cookery school while in Dublin.



The Mines marching band wows the crowd in the Dublin St. Patrick's Day Parade on March 17, 2016.

FROM MARV KAY STADIUM TO THE STREETS OF DUBLIN

The defining moment of the trip was a golden opportunity for members of the Mines marching band: performing in the 21st annual St. Patrick's Day parade while marching through the streets of Dublin. Accompanied by the Mines choir singing the fight song and a special appearance by beloved mascot Marvin the Miner, orchestra members, parents, alumni, and friends donned the classic red and black plaid flannel shirts and hard hats.

"Approximately two years ago we began the process of getting into the parade," says Robert Klimek, director of the Mines Music Program. "We had to submit videos of our half-time shows, as well as recommendations from the University of Colorado Pueblo's band director and Metropolitan State's band

"The highlight of my trip was having the opportunity to play my trumpet and march next to my daughter, who was playing her flugelhorn."

—Darien O'Brien '83

director." Video submissions were reviewed in Ireland, and the band was awarded a place in the parade with a formal invitation from the Lord Mayor of Dublin.

"At the completion of our very first music and engineering trip to Rome,

Italy, in 2012, one of the participants handed out small silver leprechaun pins telling everyone that we were destined to march in the Dublin, Ireland, St. Patrick's Day parade," says Klimek. "At the time, this seemed like a dream too large for us to accomplish. I carried that pin with me as we marched this year."

The parade experience was extra special for Mines alumnus Darien O'Brien '83, who traveled to Dublin with his wife Felicia and daughter Rosalie, a sophomore at Mines and member of the marching band. "The highlight of my trip was having the opportunity to play my trumpet and march next to my daughter, who was playing her flugelhorn," says O'Brien. "This was the first time that Rosalie and I marched together."

Both father and daughter are members of the honorary band fraternity, Kappa Kappa Psi. Rosalie gave her father



Members of the local media in Dublin interview Mines alumna and marching band member Martha Grafton '13.

marching instructions, such as keeping good posture, holding the trumpet horizontal, and keeping in line with the other trumpets. “When Rosalie was a little girl I taught her how to play the trumpet, so it was especially memorable that she was now mentoring me,” says O’Brien.

Since O’Brien’s days as a student, the Mines Music Program has grown significantly. Klimek, along with Jonathan Cullison and Maggie Greenwood, both teaching professors in the Mines Music

Program, have molded the marching band, choir, jazz band, and orchestra into internationally recognized performance groups. With support and trip planning by Catherine Skokan '70, MSc '72, PhD '75, a retired Mines professor who still plays in the orchestra, the music program has undergone significant growth. The band has even been awarded two first-place “Best of Bands” prizes by the Denver St. Patrick’s Day Parade Committee for participation in the local parade.

O’Brien recalls when the marching

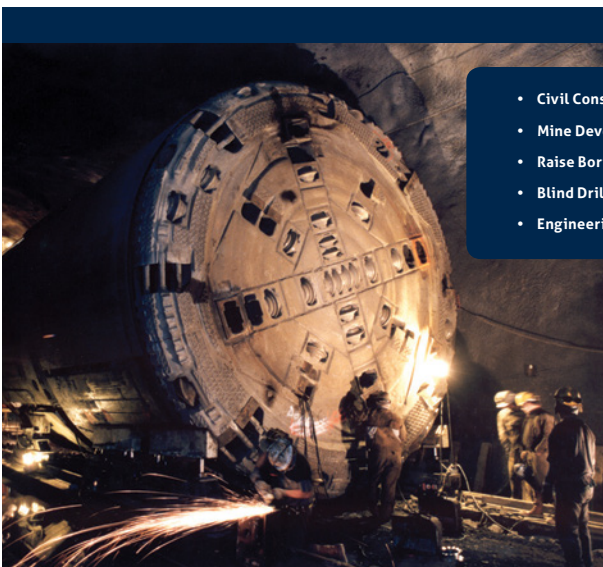
band only played at the football games and marched in downtown Golden. But in the past four years, Mines music ensembles have ventured abroad, performing in Rome, Italy, Jamaica, and Peru. Adding Dublin to the list was the icing on the cake, or, shall we say, the corned beef on the cabbage.

“I fell in love with Mines because of the people in it, and this trip was an incredible opportunity to perform with those amazing people,” says Megan Macdonald '11, MS '13. “The camaraderie amidst the frenzy of the enormous Dublin crowds was a euphoric moment in my life. It became a reunion of friends, sorely missed. The ‘M’ still stands for home, no matter where the band marches.”

—Janet Preloger

To view additional photos from the Dublin trip by Mines students, faculty, alumni, and friends, visit minesalumni.com/Dublin2016 or search #minesdigsdublin on social media.

In spring of 2017, the Mines Music Program will travel to Florence, Italy. For details about the trip, visit www.minesalumni.com/Florence2017.



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ALUMNI ASSOCIATION

Meet the Colorado School of Mines Alumni Association Board of Directors



Stu Bennett '66
Arvada, Colo.
 Director

Stu earned a Chemical and Petroleum Refining Engineering (CPR) degree at Mines in 1966. While at Mines, he lettered in soccer, played three years of football, and was a member of Beta Theta Pi. Stu went on to receive a master's degree in chemical engineering at Oklahoma State in 1968. After a few years in the industry, he attended dental school at the University of Oklahoma, graduating with his doctorate of dental surgery in 1977. He practiced general and cosmetic dentistry before retiring at the end of 2015. Stu attends and participates in numerous alumni association sponsored seminars and actively supports Mines at athletic events. He is also a member of the President's Council and the *Mines* magazine editorial board.



Mitch Kruse '85
Bellevue, Wash.
 Director

Mitch, a native of Colorado Springs, graduated from Mines in 1985 with a bachelor's degree in mechanical engineering and a minor in material science. During his four years at Mines, he played baseball, was a member and officer of Kappa Sigma, and was president of the student chapter of the American Society of Mechanical Engineers (ASME). After graduating from Mines, he spent 11 years in the oil and gas business working with Halliburton. Mitch later earned an MBA in technology management from the University of Houston. Currently, he works as the software product manager for Zetec in the Seattle area. Mitch has been the alumni association's Seattle section coordinator for the past eight years.




Aprill Nelson '08
Houston, Texas
 Treasurer

Aprill earned her bachelor's degree in petroleum engineering from Mines in 2008. As a student, she was part of the McBride Honors Program and the Multicultural Engineering Program, was active on the Senior Gift Committee, and served as the student trustee to Mines' Board of Trustees. Aprill serves as a volunteer for the alumni section in the Houston area, is on the President's Council, and has served on the Young Alumni Committee. She was awarded the Young Philanthropist Award in 2014 for her volunteer and philanthropic commitment.



Raymond Priestley '79
Denver, Colo.
 President

Ray received a bachelor's degree and a professional engineering degree in geological engineering from Mines and later earned his master's degree in finance from the University of Tulsa. He started his career building underground storage for all types of materials; projects included the SPR (Strategic Petroleum Reserve), LOOP (Louisiana Offshore Oil Port), and WIP (Nuclear Waste Isolation Project). Most of his career has focused on upstream oil and gas, exploring and developing both conventional and unconventional resources throughout North America. Ray's outside interests include adventure travel, cycling, and photography, but he is never happier than when he is playing handyman and riding around on his tractor at West Virginia Artist Retreat, which he and his wife opened.

 Find full bios for board members online at minesalumni.com/board. Interested in getting involved with the alumni association? Learn about the opportunities at minesalumni.com/volunteer.

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ALUMNA PROFILE

An Oredigger Finds Community Far From Campus

Like many transplants to the Washington, D.C., area, Katie Huckfeldt '13 struggled at first to find her footing. But, she says, the Mines Alumni Association's D.C. M Club smoothed her transition when she relocated there after graduating from Mines with an environmental engineering degree. "It was so nice to come to a new city and find people from my school," says Huckfeldt. "It was really beneficial, not just professionally but personally."

After reaching out to other alumni, Huckfeldt found a career as a patent examiner at the U.S. Patent and Trademark Office. Now, she spends her days reviewing applications for inventions related to electronic shopping to determine whether they meet the basic rules and legal requirements to be patentable. And her Mines education has proven invaluable.

"Every examiner who is hired is taught the 'law' part of patent law, but from the start we have to be able to understand the technical details of the applications," she says. "While a lot of the inventions I work on are very relatable and things you encounter every day, understanding the actual software and systems behind them requires an engineering and math background."

Eager to give back to the D.C. alumni M Club, she now serves as its coordinator, a role that allows her to use her event-planning skills and help new residents the way others helped her. The M Club has about 300 members and a busy social calendar that includes happy hours, outings to see the Colorado Rockies play the Washington Nationals, and, most recently, a river boat cruise amid D.C.'s famous cherry blossoms.

M Clubs serve an important purpose in the alumni association by giving members a sense of local community within a large organization. The D.C. M Club plays an important role for graduates because D.C. is "a city of transition," Huckfeldt says. Mines alumni can meet interesting people and network in a place that can sometimes be intimidating. D.C.'s diversity is part of what makes the section special, she says. "We have people from all over the nation and the world."

As someone who's experienced the benefits of membership firsthand, Huckfeldt especially enjoys seeing new faces at mixers. "I love being able to say, 'Hey, need someone to hang out with? You got it. Need advice on where to live, where to work? I've got an alum for you to talk to.'"

Huckfeldt thrives on the event-planning part of her role, because there are so many things to do in the D.C. area. She welcomes suggestions from members and strives to come up with outings and activities that work with members' schedules. "I also try to plan for all budgets and ages," she says.

One event she recommends to other M Club coordinators is a



As the Washington, D.C., M Club coordinator, Huckfeldt participates in many events, such as a recent kayaking event on the Potomac River.

Dan O'Sullivan

group trip to an "escape room," which she calls "a great team-building experience." The one she attended in D.C.'s historic Georgetown neighborhood drew 23 alumni, ranging in age from 20 to 70, who searched for clues and solved a series of puzzles. The group "got out with five minutes to spare," she says. "It really made everyone come together."

But getting people to attend events was a struggle when Huckfeldt first became the M Club coordinator. She boosted attendance by scheduling events regularly, getting to know members individually, and becoming a trusted resource for new residents. "The D.C. alums know my name, and they know they can contact me if they need anything," she says.

Huckfeldt gives Mines a lot of the credit for her achievements, saying that the institution put her in an amazing position to succeed. A Littleton, Colorado, native with a strong interest in science and math, she made a group of friends during her freshman year who kept her focused and met regularly to study. She honed her communications skills as a staff member of *The Oredigger*, where she worked her way up from reporter to editor-in-chief. She also worked in the Admissions Office and for *Mines* magazine. An alumna of the McBride Honors Program, she now serves on its advisory board.

Huckfeldt applauds the recent decision by Mines and the alumni association to eliminate dues and open membership to all alumni. She expects the change to boost involvement in alumni sections, especially among younger graduates who may have tight budgets.

Paying dues "can be intimidating as a young alumnus because you don't make a lot of money," she says. "For younger alums, it's just too hard starting out. All of us would love to give back once we're a little more stable."

"We all have great jobs, great careers. We're well aware that Mines gave us these opportunities."

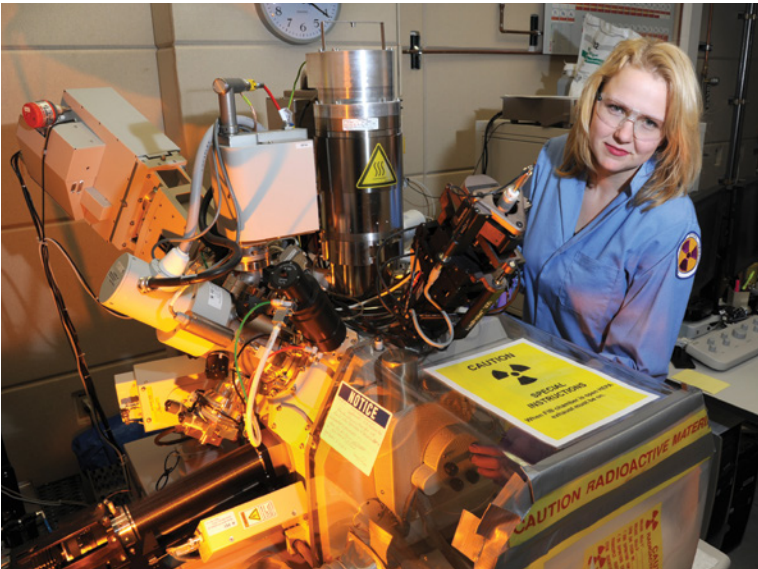
—Naomi Seldin



EDITOR'S NOTE

Class Notes are now listed exclusively online. Visit minesalumni.com/minesmagazine to see your classmates' latest accomplishments, employment changes, photos, and other updates.

To submit a marriage, birth, or other alumni news announcement for potential publication in the magazine, visit minesalumni.com/announcement.



PRESIDENTIAL EARLY CAREER AWARD FOR SCIENTISTS AND ENGINEERS

On Feb. 18, 2016, President Obama named Melissa Teague PhD '13 as one of the recipients of the Presidential Early Career Award for Scientists and Engineers. This award is the highest honor bestowed by the U.S. government on science and engineering professionals in the early stages of their independent research careers. Nominated by the U.S. Department of Energy, Melissa was selected for her pursuit of innovative research at the frontiers of science and technology and her commitment to community service.



AND NOW THERE ARE FOUR Katie (Thompson) Rockman '00 and Jared Rockman welcomed a son, Bennett William, on Jan. 15, 2015, in Anchorage, Alaska. Bennett joins his big sister, Charlotte.



SUMMER SWEETHEARTS Jacqueline Cloud PhD '14 married Collin Easton on Sept. 12, 2015, in Meredith, N.H. Tara Yoder PhD '14 attended as a bridesmaid and Mike Blaise '14 served as a groomsman. Jacqui and Collin knew each other growing up but began dating after working together at summer jobs during college. When Jacqui decided to leave New England to attend Mines for graduate school, Collin decided to go with her.



BACKYARD WEDDING Sara Post '10 and Brad Leick MS '10 were married on Aug. 1, 2015, in Duluth, Minn. The couple met in a class at Mines during Sara's senior year, while Brad was completing his master's degree. They were married in their backyard surrounded by family and friends. Eight Mines alumni attended the wedding.



A BABY MAKES THREE Dexter May '14 and Jessi May welcomed their first child, Adalynn Ruth, on Feb. 13, 2016. The proud parents have enjoyed taking their new addition to see the sites in Fort Worth, Texas. Adalynn even went to her first rodeo when she was only six weeks old.

AAPG HONORARY MEMBER AWARD

In June 2016, Rebecca Dodge MS '78, PhD '82 received one of five Honorary Member Awards given by the American Association of Petroleum Geologists (AAPG). The award honors individuals who have distinguished themselves through their accomplishments and their service to the profession of petroleum geology and to the AAPG. The AAPG is an international geological organization fostering scientific research, advancing the science of geology, and promoting technology.



ADVENTUROUS ROMANCE

Loralee Dickson '13, MS '15 and Kyle Dickson '14 were married on Feb. 28, 2015, in Galveston, Texas. The couple met in the winter of 2009 as freshmen at Mines. They had an adventurous start to their relationship, with spontaneous late-night hiking up South Table Mountain, piggybacking across the frozen Clear Creek, and skydiving in Boulder, Colo., along with many other activities during their next few years together. Over 20 Mines alumni and students attended their wedding, including Lindsay Patterson '13 (bridesmaid), Timothy Tribby (best man), Matthew Lunsford '15 (groomsman), and Chris Mondeau '14 (groomsman).



FRESHMAN FRIENDSHIP TO WEDDED BLISS Ricky Nguyen '11 and Lisa Truong '11 were married on Aug. 8, 2015, in Centennial, Colo. The couple met through the Minority Engineering Program during their freshman year at Mines and built their friendship through the Professional Asian Society of Engineers and Scientists. Mines alumni in the wedding party included Theresa Sung '11 (maid of honor), Jess Thompson '11 (bridesmaid), Sergio Villa '11 (groomsman), and Billy Duran '11 (groomsman). Other alumni in attendance were Khanh Vu '93, Ben Railsback '98, MS '00, Islin (Moy) Munisteri '09, Lucas Munisteri '09, Trang Tran '05, MS '11, Thorn Svendsen '11, Chelsey (Fedel) Svendsen '12, Sharyn Li '11, Steven Daniels '13, Eduardo Cervantes '13, Susan Tran '14, Julie Thao '14, and Richard Nguyen '14.



BONDING BROTHER AND SISTER

Jason Brucker '00 and Julia Brucker are happy to announce the arrival of their second child. The couple welcomed a baby boy, Liam, into their family on Feb. 2, 2016. Liam joins his 5-year-old sister, Mari.



SABBATICAL ADVENTURES While on sabbatical from the University of Kentucky, Mike Kalinski '85 spent the 2014-15 academic year at the American University of Sharjah in the United Arab Emirates. He served as a visiting professor in the Civil Engineering Department teaching undergraduate courses and conducting research developing seismic microzonation maps for large cities in northern Haiti. His time overseas allowed him to travel often, including a trip to Giza, Egypt, where he toured the pyramids on the back of a camel.

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Stanley Gradisar
Patent Attorney, Of Counsel
B.S., Mining Engineering, 1974



Kristen Gruber
Patent Attorney, Associate
B.S., Chemical and Petroleum Refining Engineering, 2000



Bruce Kugler
Patent Attorney, Shareholder
B.S., Petroleum Engineering, 1981



Matthew Ellsworth
Patent Attorney, Shareholder
B.S., Engineering, with honors, 2003
M.S., Engineering Technology Management, 2005
Top Graduating Electrical Engineer



Doug Swartz
Patent Attorney, Shareholder
B.S., Mining Engineering, Minor in Metallurgical Engineering, 1982



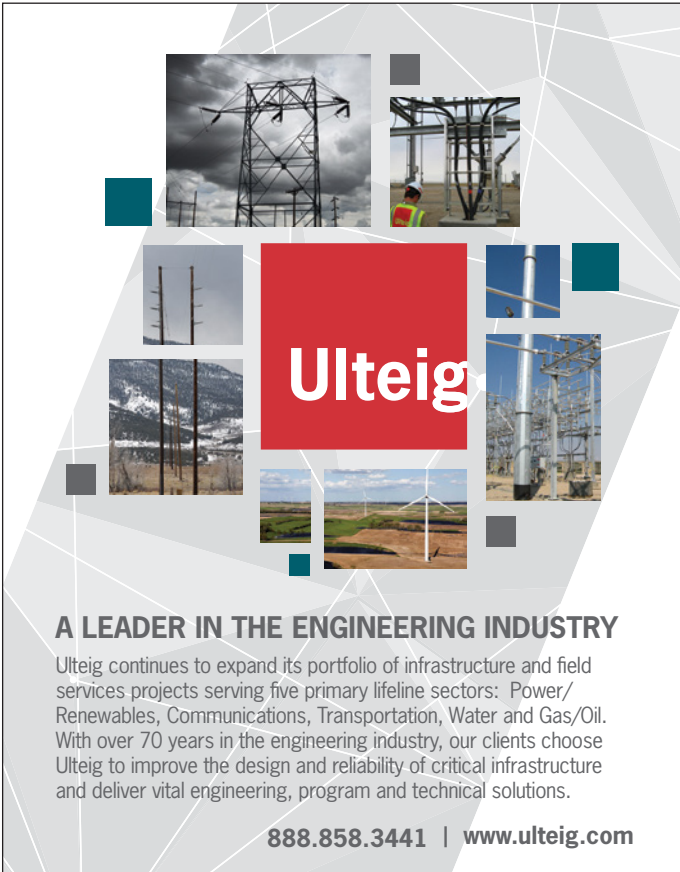
Cliff Brazil
Patent Attorney, Associate
B.S., Metallurgical & Materials Engineering; Minor Bioengineering & Life Sciences, 2011



Brad Knepper
Patent Attorney, Shareholder
B.S., Electrical Engineering, 1998

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DEDICATED TO EACH OTHER Travis Pitcher '12, MS '15 married Christina Volpi '12 in May 2016, in Del Mar, Calif. The couple met in 2009 during an undergraduate geology field trip in Glenwood Springs, Colo. They quickly became friends, but graduate school and work took them to different locations. After a three-year, long-distance relationship, they both moved back to Denver. Travis proposed in May 2015.



KILTS AND KISSES Emily Cazzell '12 married Nic Slay on Dec. 12, 2015, at Devil's Thumb Ranch in the Colorado Rocky Mountains. The couple met at the Coors Lab Tap Room through a mutual friend. All of the men surprised the bride by wearing kilts to honor her Scottish heritage and childhood. Mines alumni in the wedding party were Mary Ronat '13, Derek Patterson '11, Davis Balgley '14, and David C. Smith '11.

TOP FINANCIAL ADVISOR *Barron's* magazine recently named Brent Hablutzel '96 one of Colorado's top financial advisors in 2016 as part of its annual "America's Top 1,200 Advisors: State-by-State" rankings. Brent has worked for Merrill Lynch Wealth Management in Greenwood Village, Colo., since 2004. *Barron's* ranks advisors based on factors such as assets under management, revenue produced, regulatory record, quality of practice, and philanthropic work.

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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

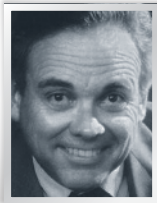
DAVID H. BEDDINGFIELD MS '91, PhD '96 died March 27, 2016. David was born in 1963 in Hampton, Va., and completed his undergraduate degree at the University of Wisconsin-Madison. He went on to earn a master's degree and PhD in materials science at Mines in 1991 and 1996, respectively. David spent his career working for Los Alamos National Laboratory as a nuclear materials safeguard expert. He also worked for the U.S. Department of Energy and the International Atomic Energy Agency in Vienna, Austria.



BETH A. BLUMHARDT MS '08 died Nov. 3, 2015 in Ann Arbor, Mich. She was born in 1982 and graduated from Michigan Technological

University in 2005 with a bachelor's degree in materials engineering. Beth then attended Mines, receiving a master's degree in metallurgy in 2008. After graduation, she returned to Michigan to work as a metallurgist at AK Steel, designing steel for the auto industry. In September 2002, Beth became a quality assurance lab supervisor for the Double Eagle Steel Coating Company. She also was active in the University of Michigan Hospital's Brain Tumor Support Group.

GENE E. BRANT '59 died Nov. 18, 2015. Gene was born in Baker, Ore., in 1937 and received a metallurgical engineering degree from Mines in 1959. As a student at Mines, he was a member of the Beta Theta Pi fraternity. Gene worked as a plant manager for the Dow Chemical Company for many years but retired from Metal Powder Products. He also worked as an independent consultant.



WILLIAM "BILL" S. CALKIN DS '67 died July 10, 2015. Born in 1933 in Ithaca, N.Y., Bill attended the University of Maine, receiving a bachelor's

degree in mathematics in 1955 and a master's degree in geology in 1959. He then earned his doctorate in geological engineering from Mines in 1967. Bill spent his career working as a geologist and taught at Mines and the University of Denver. He was inducted into the University of Maine Athletic Hall of Fame in 2009 for setting numerous school track field records. Bill was a member of the American Association of Petroleum Geologists (AAPG) and the Society of Economic Geologists (SEG). He was also a member of the Mines President's Council.



DAVID "DAVE" R. COLE '52, MS '56 died March 20, 2016. Dave was born in 1931 in White Plains, N.Y., and received an engineer

of mines degree from Mines in 1952. As a student, he was a member of the Sigma Nu and Theta Tau Honorary fraternities. Dave served in the U.S. Army until 1954 and returned to Mines to complete his master's degree in mining engineering in 1956. He was a registered professional engineer in Colorado and a Legion of Honor member of the Society for Mining, Metallurgy & Exploration (SME). He retired as president of the Colorado Mining Association after 25 years, and he also served for 39 years as secretary and treasurer of the Colorado Mining Association Education Foundation, Inc. Dave was president of the Mines Alumni Association in 1973 and was awarded the Mines Medal in 1982.



W. JERRY EVANS '76 died Dec. 13, 2015, in Grand Junction, Colo. He was born in 1953 and attended Western State University before graduating from Mines

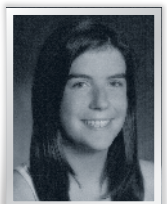
with a bachelor's degree in applied mathematics and geophysics in 1976. Jerry went on to earn his naval aviator wings and built a career in aviation. He worked in military aviation until 1985 when he became a flight engineer and, later, a commercial pilot for Continental Airlines. Jerry retired at the end of 2013.



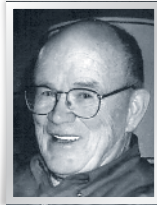
To submit an obituary for publication in the magazine, visit minesalumni.com/obituaries.

MARTHA J. HAHN MS '06 died Oct. 1, 2015, in Chicago, Ill. Born in 1974 in Beloit, Wis., Martha earned a bachelor's degree in chemistry from the University of Wisconsin-Madison in 2001. In 2002, she began working as a temporary lab technician at the Plum Creek Water Reclamation Authority (PCWRA) in Castle Rock, Colo., and was eventually hired as a permanent operations specialist. Martha went on to receive her master's degree in environmental science and engineering from Mines in 2006. She received many promotions while working at PCWRA and was the first woman to be promoted to superintendent/assistant authority manager at a water reclamation facility in Colorado. Martha returned to Mines in 2012 to pursue a PhD in environmental science and engineering, which was awarded posthumously in May 2016.

CLYDE R. INGELS '55 died Aug. 29, 2015. Clyde was born in 1931 in Pamona, Calif., and graduated from Mines in 1955 with a bachelor's degree in geophysical engineering. He spent his career at General Dynamics/Hughes Corporation, where he eventually became director of engineering. Clyde was also an active member of the American Contract Bridge League and achieved life master status.



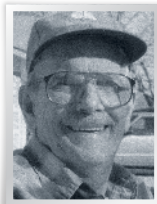
LENAE I. JOHNSON '13 died March 2, 2015, in Texas. She was born in 1991 in Seattle, Wash., and graduated from Nathan Hale High School. Lenae received a bachelor's degree in engineering physics from Mines in 2013. While at Mines, she held several jobs on campus, including working for the administrative offices, parking services, and the cafeteria. Lenae returned to Seattle after graduation and worked for a Boeing subsidiary before accepting a position at the University of Hawaii as a field researcher.



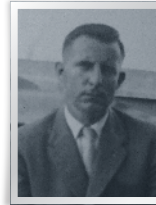
COOPER B. LAND JR. PhD '71 died March 11, 2016. Born in 1936 in Hot Springs, Ark., Cooper received a doctoral degree in geology from Mines in 1971. He taught geology at Mines and worked as a petroleum geologist in North Dakota and the surrounding states. Cooper was a member of the American Association of Petroleum Geologists (AAPG), the American Institute of Professional Geologists (AIPG), and the Society of Sedimentary Geology (SEPM).



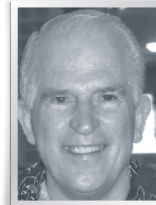
CRAIG O. MALIN '52 died July 10, 2015. He was born in 1930 in Stockton, Calif., and was raised in Panama. As a student at Mines, Craig played clarinet in the marching band and graduated with a metallurgical engineering degree in 1952. Following 16 years working at Aerojet Rocketdyne in Canoga Park, Calif., choosing metals and processes for rocket engines, he attended law school at night while working as a patent agent during the day. He passed the California State Bar in 1974 and began a new career as a patent attorney for Rockwell International Science Center. Craig retired in 1989.



HAROLD C. MCLRATH '58 died April 19, 2016. Born in 1930 in Salt Lake City, Utah, Harold served in the U.S. Air Force as a meteorologist. After his military service he attended Mines, receiving his bachelor's degree in geology in 1958. He worked as a geophysical systems analyst for the entirety of his career.



GORDON M. MINER '48 died March 11, 2016. He was born in 1923 in Golden, Colo., and served in the U.S. Army Signal Corps, South Pacific, during World War II. Gordon graduated from Mines in 1948 with an engineer of mines degree. He was the deputy director of the U.S. Bureau of Mines during Ronald Reagan's presidency and the chairman of the American Mining Committee on Health and Safety. He also served as the director of the Idaho and Utah Mining Associations and was a founder of the National Mining Hall of Fame in Leadville, Colo. In addition, Gordon was a member of the Society of Mining, Metallurgy & Exploration (SME).



ROBERT "BOB" W. MURRAY '66 died March 14, 2016. Bob was born in 1943 in Houston, Texas, and graduated from Mines in 1966 with a bachelor's degree in chemical and petroleum refining. As a student, he was a member of Sigma Phi Epsilon fraternity. After graduation Bob worked for DuPont, but he later went on to start his own fire protection and safety company, Webb, Murray & Associates, Inc., in LaPorte, Texas. He retired in 2010.



JOHN R. NEWMAN '76 died Feb. 21, 2016. John was born in 1954 in Seminole, Texas. In 1976, he received a chemical engineering degree from Mines. John spent 40 years in the oil industry, working all over the world.



LAWRENCE OGDEN '58 died Oct. 22, 2015. Born in 1919 in Maryville, Mo., he received a bachelor's and master's degree in geology from the University of Tulsa. Lawrence then became an instructor at Mines, where he received his doctorate in 1958. While at Mines, he did extensive summer geological field work and worked on individual projects in most of the western states for engineering firms, oil companies, and government agencies, which included determining the location for NORAD. He taught at Mines until 1963 when he was recruited by Eastern Michigan University. He retired in 1989.



ERIC A. PETERSON '59 died Oct. 29, 2015. Eric was born in 1935 and graduated from Mines with an engineer of mines degree in 1959. As a student at Mines, he was a member of the Sigma Phi Epsilon fraternity. Eric served in the U.S. military from July 1959 to January 1963 and then developed a career as a mining engineer. He eventually became chief

engineer of FRM Minerals, Inc., and then director of Minerals Plus, Inc., in 1987. He also worked as a mining consultant until his retirement. Eric was a member of the Society for Mining, Metallurgy and Exploration (SME).

NEBURI N. REDDY '67 died November 17, 2015 in Palatine, Ill. He was born in 1938 in Girmapur, India, and moved to the United States in 1962. Neburi received a professional degree in chemical engineering from Mines in 1967. He worked for Ambitech Engineering Consultants, from which he retired.

DEWAYNE R. SCHROEDER '64 died April 6, 2016, in Lamar, Colo. Born in 1940, Dewayne received a degree in petroleum engineering from Mines in 1964. As a student, he was on the wrestling team and placed fourth in the 1964 NCAA tournament. For the majority of his career, Dewayne worked for the Colorado State Engineer's Office, specializing in groundwater modeling and litigation. He retired in 2000 and moved to Lamar, Colo., but continued to work part-time as a consultant in water rights trials.

ROBERT "BOB" K. WILLIAMS '57 died April 14, 2016. Bob was born in Walla Walla, Wash., in 1933, and earned a metallurgical engineering degree from Mines in 1957. As a student at Mines, he was a member of the ROTC. After college, Bob served as a Second Lieutenant in the U.S. Army before earning a PhD in metallurgical engineering from the Carnegie Institute of Technology. He worked as a research scientist for 35 years at the Oak Ridge National Laboratory in Knoxville, Tenn., and retired in 2000.



JOHN "JUAN" H. WILSON II '48 died April 3, 2016. Born in 1927, Juan attended Mines at the age of 16 and received a professional degree in petroleum refining in 1948. Juan served in the U.S. Army Corps of Engineers until 1953. He then earned a master's degree in business administration from the University of Dallas in 1976. With his father, Juan started Wilson Exploration Company and also worked for Piper Petroleum Company. He was elected president of both companies in 1991.

—Compiled and written by Ashley Spurgeon

ALSO REMEMBERED

RICHARD J. ARNOLD '49..... April 4, 2014
THEODORE BACKSTROM '59..... February 11, 2014
ERIC A. BAYLEY '70..... December 17, 2014
HAROLD J. BENNETT MS '73..... July 18, 2015
ROBERT BERNSTEIN '42..... December 14, 2014
GERRITT H. BRYANT '53..... March 13, 2014
DONALD L. COULTHARD '58..... December 11, 2014
HENRI P. FREYSS MS '57..... March 21, 2016
DAVID F. GEORGE '81..... May 15, 2014
ROBERT B. GRAMMER '69..... June 26, 2015
KEVIN L. HATHAWAY '91..... May 6, 2015
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RICHARD W. HUTCHINSON..... February 21, 2016
HENRY INOUE '43..... September 30, 2014
GEORGE C. KANE '60..... May 15, 2014
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CHARLES F. KLUTH..... May 24, 2015
WALTER J. LOCHMANN '52..... January 2, 2014
CLARENCE D. MEIS '78..... June 6, 2014
THONI V. PHILIP MS '51..... June 18, 2014
ROBERT W. RANDOLPH '66..... March 28, 2014
ALAN M. SIMPSON '44..... July 1, 2014
NORMAN S. SMITH '58, MS '66..... May 26, 2014
HERBERT D. WATERMAN '50, MS '55..... May 30, 2015
WILLIAM E. WELLS '51..... January 19, 2014

Correction: James A. Montgomery '52 died September 30, 2014, not September 3, 2014, as was stated in the Spring 2016 issue.

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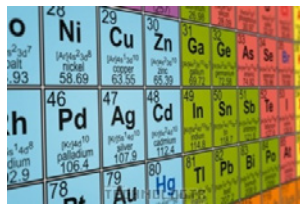
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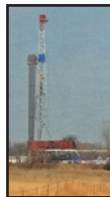
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MINES HEARTS WATER POLO

The Mines Water Polo Club strikes a heart-shaped pose in the pool at the Student Recreation Center at Mines. Founded just three years ago, the club is one of the fastest growing co-ed groups on campus. As it represents Mines at the local, regional, and national level, Club Water Polo encourages and supports camaraderie, teamwork, physical fitness, and sportsmanship among both its members and other teams in the Rocky Mountain region.

The photo was one of three finalists in the “I Dig Mines” photo contest, held in February and sponsored by the Mines Philanthropy Council. For information about Club Water Polo, visit <http://recsports.mines.edu/Club-Water-Polo>.



Jonathan Paz



Interested in having your photo featured on the Miner's Pic page of *Mines* magazine? We're looking for unique and artful shots taken by or featuring Mines alumni. Submit your photo for consideration via our contact form at: <http://minesmagazine.com/contact-us/>.

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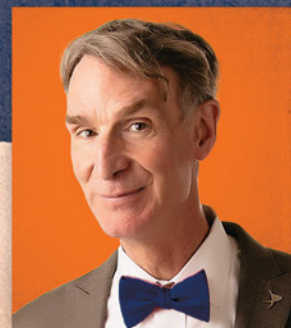
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