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THE HARDROCK™

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About the Cover
South Dakota Mines is becoming known as a technology pipeline, sending well-qualified graduates to software jobs with the biggest high-tech companies.

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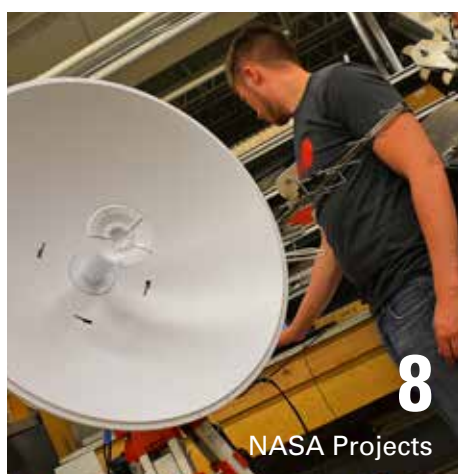
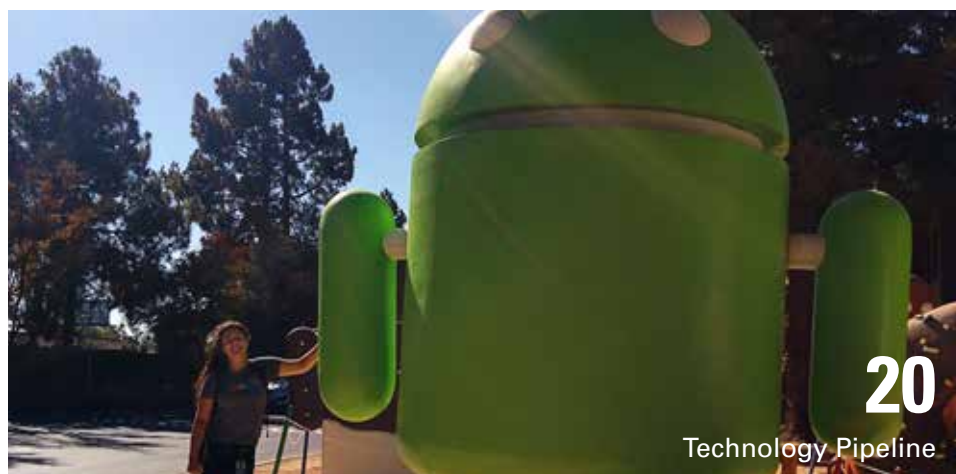
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Dear Alumni and Friends,

I am very excited about this opportunity to serve as the president of the SD Mines Alumni Association, proud to be a graduate of SD Mines, and honored to represent SD Mines and all the very successful graduates of the university, our alumni.

The university has a strong strategic plan with six main goals—growth, financial stability, and, most of all, a focus on making students successful. The Alumni Association is in a good position to support two of those goals—specifically tapping into the time, talents, and resources of our accomplished alumni.

The Alumni Association has been working hard on its strategic plan—one that incorporates past work, learning from other universities on where/how we can support SD Mines, and, most importantly, feedback

on what is going well and what alumni would like to see different.

What we are hearing:

- Our alumni are proud to be graduates from SD Mines and are interested in being involved in keeping the university successful in providing excellent education.
- Alumni want to get together and have fun, particularly at regional events.
- Alumni want to hear what their friends are up to through various communications.
- Young alumni want to learn from experienced alumni about their successes.

And it is the Alumni Association's responsibility to help facilitate this direction.

In our strategic plan, we have laid out three key pillars:

Build connections

- Engage students to make them feel part of the family and help them succeed
- Engage alumni in various activities throughout their lives, particularly at regional events where they can connect

Support alumni

- Help alumni succeed by providing professional networking and mentoring
- Recognize our alumni for their great achievements

Collaborate with partners

- Support the university by helping to recruit students, advise departments, share our knowledge and experiences, and by connecting with companies
- Work closely with our partners: the Foundation and Hardrock Club

We have a board that is engaged, and we are excited to have Larry Simonson as our executive director. We are in the process of establishing area chapters around the US to ensure we are connecting with alumni and setting up fun regional events and activities. We ask that you make sure you are part of the fun—support the school, join events and activities, and, if you have a talent, let us tap into it.

I truly look forward to my time as Alumni president and what we can accomplish together.

Karen (Nelson) Swindler (ChE 88)

2017 President

SD Mines Alumni Association



President Calvin Coolidge and First Lady Grace Coolidge spent an hour touring the Museum of Geology during their 1927 visit. They are photographed on the Mines campus with School of Mines President C.C. O'Harra and Joseph Connolly (in back).



Personnel from the US Bureau of Mines Rescue Car stationed in Lead traveled to campus in 1927 to train mining and metallurgical engineering students in mine rescue and first aid, a required instruction.

90 years ago 1926-1927

President Calvin Coolidge and the First Lady visit campus, spending an hour touring the Museum of Geology. Forty seniors receive their diplomas at the institution's fortieth annual commencement ceremony. Governor William Bulow delivers the commencement address. The US Bureau of Mines Rescue Car stationed in Lead, South Dakota, trains mining and metallurgical students in mine rescue and first aid, a required instruction. Construction begins on the Athletic Training Building, now the Music Building.

80 years ago 1936-1937

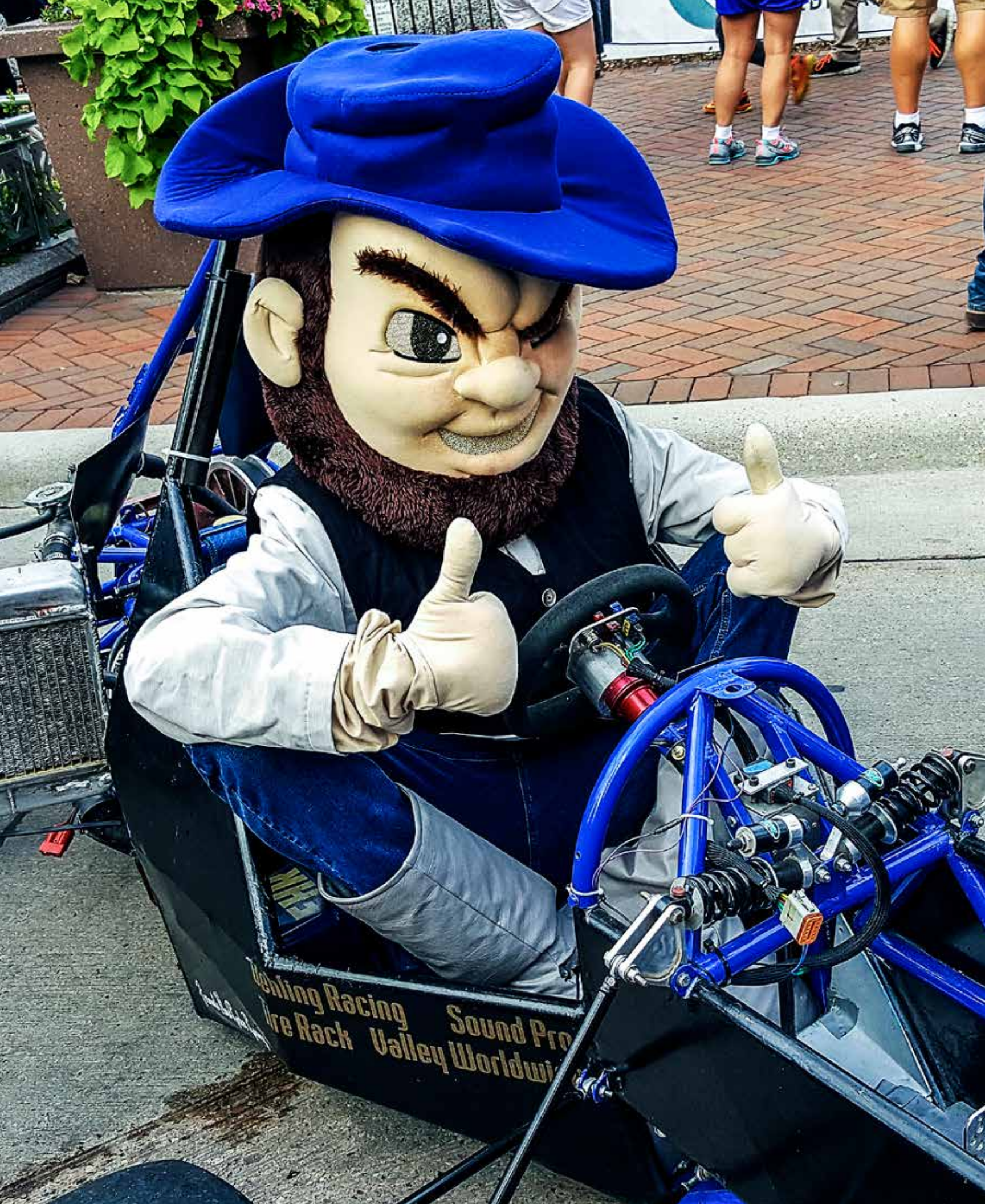
The first master's thesis is written by Wesley C. Potter and Jerome Marvin Rosen, under the direction of Dr. Andrew Karsten. The first Miners varsity boxing team under Coach HB Goodell finishes fourth in the state tournament. Dr. John Paul Gries begins his forty-year career at South Dakota Mines. A two-hundred-four-foot radio tower is erected on the south side of campus, boosting the WCAT radio signal. Works Progress Administration crews grade a slough on the east edge of campus for the new football field.

60 years ago 1956-1957

The Glee Club is renamed Singing Engineers, with sixty-five students participating and traveling throughout the state to perform. The Chemical & Biological Engineering/Chemistry Building is ready for occupancy in April. Four teams participate in the first annual Hardrock Holiday Tournament. The campus upgrades its telephone system. Callers may now dial directly to any extension on campus without going through the switchboard. ROTC becomes mandatory for all freshmen and sophomore men.

20 years ago 1996-1997

The Hardrock women's basketball team wins its conference championship. Museum of Geology personnel spend the summer excavating dinosaurs in Wyoming; camels, coyotes, and other fossils in Lawrence County, South Dakota; and turtles near Chamberlain, South Dakota. The Devereaux Library offers free Internet classes to the community. Mines hosts the Rocky Mountain Regional Conference concrete canoe races at Canyon Lake, with the hometown team winning first place and a trip to the national finals. The Solar Motion team unveils its new solar car, "Dakota Sun."





Dear Hardrockers Friends,

At the career fair in September, the line of students to talk with Google twisted around the black pipe and drape separating rows in the gym. Google was certainly the hot ticket, but it wasn't the only familiar name. Microsoft, Garmin, Echostar, and others were on campus looking for the key to corporate success in the next decade: great talent.

I met with the representatives of these companies and others who serve on our industrial advisory board for the math and computer science department. Every year, representatives from these companies help us by spending two days reviewing our curriculum and programs to help Mines stay sharp.

Their insights were interesting. While we are doing a good job staying abreast of changes, what matters most is what endures at Mines: a commitment to the fundamentals of computer science and algorithms and an emphasis on team-based problem solving. Other universities have followed trends toward gaming, coding, and cyber or web design. That's good enough for a lot of IT jobs, but the best companies are looking for deep mastery of computer science that Mines provides.

At lunch with the founder of Black Hills Information Security—an ethical hacking company that finds and fixes vulnerabilities in corporate computing systems—I heard the same and more. Our students are great at computer science. They also persist. They won't give up until they solve the problem.

The size of our program has grown, making it worthwhile for more major companies to look for talent in Rapid City. In 2010 we had about 130 computer science majors. Today, we have over 200.

The diameter of our technology pipeline is increasing and we are committed to keeping the quality of our graduates very high—in computer science, computer engineering, and every other discipline we teach.

Warm Regards,

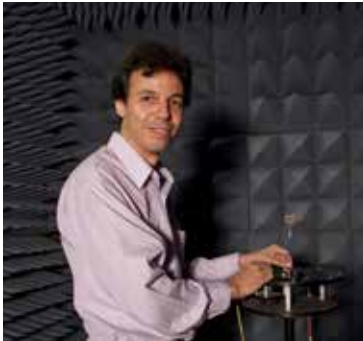
A handwritten signature in black ink that reads "Heather". The signature is stylized with a large, sweeping initial 'H' and a cursive 'eather'.

Heather Wilson
President
South Dakota School of Mines & Technology

Ask the Mines Expert

Dimitris Anagnostou, PhD

Department of Electrical & Computer Engineering
Research website: <http://anagnostou.sdsmt.edu>



Antenna research at SD Mines has attracted more than \$1 million in funding in recent years. How does your work help solve real-world problems?

In the early 1990s, antennas were mostly on radios, TVs, mobile phones, and military equipment. Today, we have devices and applications requiring antennas to be placed practically everywhere: smartwatches, printers, patient monitors,

wearable electronics that talk to each other, car navigation systems (GPS), satellites, and other objects. Data speeds of the next generation (5G) systems will reach one gigabyte per second, allowing us to download a movie in just one second, for example. This will be achieved only using advanced technologies with multiple antennas and base stations.

Our research focuses on new ways to inject additional functionalities into antenna systems, creating designs that are more efficient, smaller, and better-performing. Examples include mobile phone antennas with better signal reception and reduced battery consumption; satellite antennas that enable tracking to a thousandth of a degree; antennas with on-demand rejection of specific frequencies (such as anti-jamming); and smart beam-forming antennas that always radiate toward a specific target, even under severe flexing like that experienced by airplane wings in extreme weather. Recently, we also started to develop antennas and microwave components using inks and smart phase-change materials.

We are also collaborating with NASA to construct not only antennas but the fundamental components (resistors, capacitors, inductors) to allow in-situ printing of a sensing platform in space. This could lead to new knowledge and revolutionary electronic components for radio applications.



An expanded Tiospaye Center to support Native American students was dedicated in the fall to Maria "Agnes" Roybal Trujillo. A donation by Diane and Bob Malone (second and fourth from left) of Texas enabled SD Mines to increase the size of the center from 200 to 450 square feet.



Giving Back

Alumnus Endowment Funds Chemical Engineering Laboratory, Scholarships

Gary Veurink	ChE 72	Retired Dow VP
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Alumnus Gary Veurink (ChE 72) is a model of philanthropic good deeds, whether giving back to his alma mater, the stepping stone for his career successes, or to those much less fortunate than himself.

After graduating from Mines, Veurink rose through the company ranks at Dow Chemical to become a corporate vice president with direct responsibility for global manufacturing and engineering operations, including all new capital projects. This included a 23,000-employee organization in thirty-nine countries, as well as an annual \$4 billion operations budget and a \$2 billion-plus new-projects budget.

He retired after thirty-five years with Dow, but he was far from done making an impact on the world. Following his retirement he spent six years as chief operating officer at Washington, DC-based International Justice Mission, a human rights agency that protects the poor from violence. He continues to be involved in the group’s mission work.

Several years ago Veurink and his wife, Ruth, established an endowment that in the fall of 2017 will fund the first

prestigious Gary and Ruth Veurink Scholarship award covering at least half a student’s annual tuition and fees.

It will also fund continuous experiment upgrades and infuse future innovative technologies in the Veurink Chemical Engineering Unit Operations Laboratory dedicated in his honor last fall. The 5,000-square-foot lab features a two-story distillation column and other pilot-scale equipment similar to what students will use in industry after they graduate.

Married for forty-six years, among the many groups through which the couple have given back over decades are Young Life, Junior Achievement, and Boy Scouts.

“We believe our career success, the goodness we have experienced in our marriage and family, the associated financial resources we have are all gifts from God, and we are intent on honoring him in our gifting. We also feel quite strongly that the SD School of Mines was a critical aspect of our lives and we want to express our gratitude in a tangible way to the institution and be active in highlighting that the institution was instrumental in our lives,” Veurink says.

Undergraduates

Look to Improve Quality of Life with NASA Projects



This multi-spectral camera developed by electrical engineering major Conrad Farnsworth led to a research project for NASA. Opposite page: student research teams plan their next steps.

NASA-funded research is being conducted at all levels on campus, from undergraduate to faculty. Two new student-led balloon projects could help farmers grow more food to meet an ever-increasing demand and guide scientists to improve connectivity in rural parts of the world.

The research projects were each funded at \$200,000 for two years through NASA's Undergraduate Student Instrument Project—Student Flight Research Opportunity program. Students at the South Dakota School of Mines & Technology wrote the initial proposals and are working with NASA's scientists and engineers as they move their designs from concept to the physical build phase.

Both balloon projects will be carried out in collaboration

with Raven Aerostar International at its Sioux Falls, South Dakota, and Sulphur Springs, Texas, facilities. Raven is an industry affiliate of the South Dakota Space Grant Consortium, which is headquartered on campus.

The School of Mines was among just four of the forty-seven winning universities nationwide to be awarded two such NASA grants. "One of the things that distinguishes these NASA projects from other research projects is that they are student-led all the way from the proposal stage to project completion. The fact that Mines got both proposals funded speaks to the quality of students as well as to faculty mentors," said Tom Durkin (MS Geol 86), deputy director of the South Dakota Space Grant Consortium.

The projects are:

- **Low Cost Multi-Spectral Imager for Aerial Crop Monitoring**—Students are developing a cost-efficient imager capable of monitoring crop health from an airborne platform suspended beneath balloons at higher rates and resolutions than the \$850 million Landsat satellite, which is currently state-of-the-art in multi-spectral observation. This will allow the agriculture industry to correlate the health of crops with the effects of short-lived or localized phenomena that cannot be normally observed. Nearly 75 percent of farmers believe more data will help improve yields. This is important because nearly 13 percent of people worldwide don't have enough to eat, and food production must double by 2050 to meet demands of the growing population, according to the United Nations.
- **Acoustic Temperature Measurement of Lift Gas in High-Altitude Balloons**—This project will more accurately measure the helium lift-gas temperature and composition in high-altitude balloons. For super-pressure balloons this is needed to determine when to bring the balloon down. As the lift-gas temperature and composition measurements improve, balloons have the potential to stay at altitude for longer periods of time, increasing mission lengths at the edge of the atmosphere. This could help technology giants bring interconnectivity to rural parts of the world, transform global aviation, and improve the quality of life in other ways.

The imaging proposal and subsequent NASA project is the result of a multi-spectral camera that senior Conrad Farnsworth, an electrical engineering major, built in the summer of 2015 during a Research Experience for Undergraduates. Soon after, Farnsworth and Adrian Del Grosso, a senior computer engineering major, learned about NASA's call for proposals for balloon imaging devices.

"I was looking for uses for the prototype and noticed that, among many other things, you can determine the quality of

health of crops by paying attention to very specific spectra," Farnsworth says. "Given that we had an instrument, the camera, and an area of application very close to home, farms and ranches, it only made sense to ask for money to improve upon our simple prototype and fulfill one of the strategic goals of NASA."

The two projects offer many types of invaluable opportunities for students, from research to project management.

"This design experience involves the highest level of skill that graduates will use in industry. It combines all our technical knowledge into a way of thinking that drives efficient product development," says Del Grosso, student team



lead and computer engineering lead on the imaging project. He is designing the communications subsystem. "We all have different career goals, but we hope that this design experience will place us above the competition in the job market.

Not many students write proposals that are funded by NASA. Personally, I hope to find a career in engineering here in South Dakota after I graduate in May."

Joree Sandin, a mechanical engineering senior who will graduate in 2018, also helped write the NASA proposals.

She has narrowed her career choices to the mechanics and materials of the biomedical field or space exploration research, two divergent paths but ones for which she feels immensely prepared thanks to her experiences at Mines.

"The projects at this campus are super focused on solving real-world problems. It's not just playing in a sand box and tearing it down. With this multi-imaging project we can help improve the lives of others," Sandin says.

In addition to Del Grosso, Sandin, and Farnsworth, other students who contributed significantly in preparing the proposals were Austin Burch, Paul Christenson, Trevor Jerome, and Cory Mergen. Jason Ash, PhD, Department of Mechanical Engineering, and Charles Tolle, PhD, Department of Electrical & Computer Engineering (ECE), are principal investigators with assistance from ECE adjunct instructor Lowell Kolb.





Mines Leads Once-in-a-Lifetime Solar Eclipse Project

A team of Mines students is getting a front-row seat to a once-in-a-lifetime astronomical event, this summer's total eclipse of the sun.

The Students for the Exploration and Development of Space organization has taken the lead in developing tracking and imaging systems for the state's NASA team dedicated to the National Solar Eclipse Balloon Project. The national project will conduct research in the upper levels of the Earth's atmosphere during the total eclipse, which will pass through western Nebraska on August 21, 2017.

The multidisciplinary team is also comprised of Mines' Society of Physics Students, which is working with high school students to design and build a secondary radiation payload, which will conduct experiments from the ground.

Students and professors from other universities throughout the state, as well as K-12 educators and students, are also on the South Dakota team, which is being directed by the education and outreach department of the Sanford

Underground Research Facility. A Project Innovation Grant for the operation was obtained from the South Dakota Space Grant Consortium headquartered at Mines.

A high-altitude balloon launched during the eclipse will be equipped with a video imaging payload designed by Mines students. The imaging devices will livestream the event to a NASA website, and two detectors will measure primary and secondary cosmic rays, looking for changes due to fluctuating atmospheric conditions during the eclipse.

A public viewing event in Alliance, Nebraska, as well as at science centers and museums throughout South Dakota will show pictures taken from the balloon.

"It's not often you get an opportunity to work on an aerospace project with big dollar equipment," said Zach Christy, a computer engineering junior leading the Mines effort. Christy's career goal is to land a job at Lockheed Martin after graduation in 2018. He already has a co-op experience with Raven Aerostar on his résumé.



"Marathon Valley"

"Wharton Ridge"

"Bitterroot Valley"

"Spirit Mound"

"Lewis and Clark Gap"

Wharton Ridge on Mars

Honors Former Mines President

NASA has honored former South Dakota Mines President Robert Wharton by naming a prime piece of Mars real estate after him. The 330-foot-long Wharton Ridge keeps good company, bumping up against the Lewis and Clark Gap and separating the wide Marathon Valley and Bitterroot Valley on the so-called Red Planet.

Wharton Ridge was discovered by the Mars rover Opportunity during its historic extended mission, which ended in September. The sixty-five-foot-wide ridge is as high as approximately a thirty-story building and features a number of large boulders.

A lifelong explorer, President Wharton participated in eleven expeditions to the Antarctic. During the course of his career, he worked in the Life Sciences Division at NASA headquarters in the late 1980s, served as a visiting senior scientist at NASA headquarters, and was executive officer for the National Science Foundation's Office of Polar Programs.

President Wharton was an astrobiologist who was a "pioneer in the use of terrestrial analog environments, particularly in Antarctica, to study scientific problems connected to the habitability of Mars," according to the NASA announcement of Wharton Ridge. He became president of SD Mines in 2008 and died in 2012.

"Dr. Wharton and his work are still remembered fondly here at South Dakota Mines. Having a ridge named for him on Mars is appropriate and would likely make him smile," said Heather Wilson, who succeeded Wharton as Mines president in 2013.

This Mars scene from NASA's Opportunity rover shows the full extent of Wharton Ridge, which forms part of the southern wall of Marathon Valley on the western rim of Endeavour Crater.



POET courtesy image/Mines alumnus Jeff Heikes at the Project Liberty plant in Iowa

CHANGING THE ENERGY LANDSCAPE

Alumnus Takes On the First Commercial Cellulosic Ethanol Plant

Out of America's heartland has emerged one of the biggest ethanol producers in the world: POET, a South Dakota-based company that has defined the art of biorefining for the past twenty-five years. A Mines alumnus has played a major role in this new energy future.

From design to completion, POET's Jeff Heikes (ChE 99), vice president of engineering project management, helped bring online Project Liberty, the world's first commercial cellulosic ethanol plant headquartered in Iowa. It produces clean-burning, high-octane fuel from the most abundant organic compound known to humankind, cellulose.

Making ethanol from corn is not difficult, but making ethanol from waste products—cobs, stalks, leaves, and husks—at commercial scale is a real breakthrough.

The facility will produce 25 million gallons of cellulosic ethanol per year from such waste—the equivalent of fueling NASCAR's national race for three centuries. More importantly, it will replace 1.32 million barrels of crude oil and will save 210,000 tons of carbon dioxide emissions annually, all while generating \$22 million in new revenue for farmers throughout the Midwest.

It is a radical idea on a commercial scale, and it's garnered international acclaim. The grand opening of the plant, a joint venture between POET and Dutch multinational Royal DSM, was attended by the King of the Netherlands, the

Department of Energy's deputy undersecretary, and the US Secretary of Agriculture, who called for 1,000 more plants to be built by 2040.

According to the Department of Energy, the 1.3 billion tons of harvestable cellulose in the US alone could meet more than one-third of the domestic transportation fuel demand.

POET plans to tap into its existing biorefineries to build additional plants, a billion-gallon-per-year opportunity.

"It's unique because this is transferrable anywhere there is biomass, from the plains of Africa to South America to the forests of the northwestern US. This technology solves energy needs, supplements agriculture, and we can make it available worldwide," says Heikes, who attributes his success as a POET leader to the many lessons learned at Mines—among them understanding the talents of others and the value of teamwork to achieve the unthinkable.

The practical applications that were woven in as such a large part of his educational foundation were strengthened by the communication and business emphasis taught at Mines. Heikes says a number of undergraduate internships further sharpened his readiness for a quick rise in industry.

Mines' reputation for producing outstanding science and engineering leaders has led to POET employing nearly twenty-five grads, a number Heikes hopes to expand through opportunities like Project Liberty.

STUDY ABROAD FOCUSES ON INTERNATIONAL TEAMWORK



A growing number of students at South Dakota Mines are boosting their resumes and skills in the international workforce with study abroad programs.

Mines chemical and biological engineering professor Dave Dixon, PhD, (ChE 78) developed a partnership with the Technische Universitat Darmstadt while on a Fulbright sabbatical at the German engineering school. The initial Introduction to German Engineering (IGE) course has been offered for five summers. A capstone senior design course called Advanced Design Project (ADP) followed two years ago. Since the partnership began, forty-three Mines students have studied in Germany, with another seventeen traveling abroad this spring and summer. Five German students from Darmstadt have studied chemical and biological engineering at Mines.

Victoria Oveson (ChE 16) participated in the advanced course last spring and says her experience collaborating with an international team of students to design a low density polyethylene facility has shaped her career aspirations.

“It’s the solidifying factor in realizing how all of your separate classes pull together to be used practically to solve large-scale





problems,” says Oveson, who graduated in December.

Her team’s project was commissioned by Holland-based engineers from Sabic, a chemical manufacturer serving the automotive, plastics, pharmaceutical, and other industries. At the end of the program, students toured the facility they were designing in the Netherlands.

The opportunity to work on a multidisciplinary international team and see all the moving parts come together are invaluable experiences to take into the workforce. “It’s something that the standard engineering major will not get to experience until after graduation,” Oveson says.

“There is so much to learn from collaborating with a point of view completely different than your own, and I believe traveling is critical to self-development and professional improvement,” Oveson says. “After my experience I will only

be able to work for a global company.”

Civil engineering junior Michael Mansfield traveled abroad for the first time as a freshman in the IGE program.

His team was tasked with developing a protective suit for healthcare workers with an integrated cooling system that allows people to maneuver easily. Mansfield was the only engineering major on a team of eleven biology majors.

“I learned that not everyone understands the engineering way of thinking, and engineers must be able to communicate their thoughts and calculations to non-engineers. It is often vital to a project’s success,” Mansfield says. “I also learned that engineers must rely on other disciplines. I had to trust that the biologists knew what they were talking about, because I did not fully understand what they were doing with the virus identification system.”

His experiences in the IGE program in Germany fueled a desire for international humanitarian projects. He has since traveled to Arusha, Tanzania, where he surveyed a school to develop a water system, and to Chile, where he designed and installed solar panels at an orphanage. He is president of the Engineers and Scientists Abroad student group on campus.

As a Brass Life Award recipient, he is participating in a study abroad experience this spring at the Oslo and Akershus University of Applied Science in Norway.

Rebecca Pinkelman (MS ChE 10, PhD CBE 14,) coordinated the IGE course while a post-doc at Darmstadt. She recently joined Mines as a lecturer.



SENIORS GIVE BACK TO ALMA MATER EVEN BEFORE GRADUATION

Graduating seniors not only leave with a degree, but they also leave something behind—a class gift to the school as both a thank-you and a reminder of their years on campus.

In what it hoped would become a new senior tradition, the Class of 2015 gave the rock garden at the southeast corner of the Classroom Building. Complementing that class gift, Dusty Swanson (ME 15) and his family donated the large boulder at the northeast corner of the Mineral Industries Building as a welcoming point onto campus.

The Class of 2016 decided to go in a different direction—up. The class has engineered a retaining wall on the top of M Hill to serve as both a protective barrier for reunion plaques and a bench for climbers.

The Class Gift Committee noticed earth around the alumni plaques atop M Hill was eroding, so the Mines chapter of the American Society of Civil Engineers proposed a retaining wall to help shield plaques from the effects of weather. The two groups partnered to raise funds, plan a design, and provide

labor. Led by civil and environmental engineering major Dalton Lyons, the wall was built by a group of seniors last fall, preserving the plaques and serving as a place for alumni and other climbers to sit and reflect atop M Hill.

Class gifts are an important way to show alumni how their donations can directly impact the university.

Dustin Dunn says he decided to get involved with the senior gift project to repay the School of Mines for his exceptional college experience.

“This school has given me so many opportunities over the past four years, and I figured there couldn’t be a better way to start giving back now,” says Dunn (ME 16).

Gina Rossi (CE 16), another member of the Class Gift Committee, says the gifts are also an important way to help improve campus.

“Class gifts allow us to give back to the university that has given so much to us. Our desire as the Class Gift Committee is to promote a culture of volunteerism and giving back as soon-to-be alumni, and we feel that a class gift is a way to accomplish that while enriching the campus,” she says.



From Mines to the Super Bowl

Alumnus Takes Skills into High-Profile Athletic Stadiums

Korey Kirschenmann	EE 05, MS EE 07	ME Engineers, Denver
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When Korey Kirschenmann (EE 05, MS EE 07) played basketball for the Hardrockers, he never imagined that one day he would be designing electrical systems for high-profile sports facilities such as the Marlins Stadium, the Dodgers Stadium, and even glitzy halftime shows of several Super Bowls.

After leaving Mines with bachelor's and master's degrees, he landed a job at ME Engineers in Denver and began consulting on sports arenas and other facilities including airports, apartment complexes, and medical buildings.

The needs of each project vary.

Dodgers Stadium dates back to 1962, so Kirschenmann and his team designed and coordinated a complete electrical infrastructure upgrade. Kyle Field at Texas A&M required major renovations and an expansion, so his team consulted on the design of almost the entire facility.

Kirschenmann enjoys seeing fan reactions to their new stadiums. In the renovations at Kyle Field, the east and west

parts of the venue were replaced, and capacity was increased to over 100,000.

"My wife and I were there for the first home game after the second phase of renovations at Kyle Field, and it was great to hear the awed reactions of the students, alumni, and other fans to the new facilities," Kirschenmann says.

He says his education at Mines prepared him for his fast-paced engineering career by teaching him good habits such as how to study effectively and providing him with the support he needed to succeed.

"I have learned since graduating that the education I received, in smaller classes with professors that cared about each student, was unique. Being a student-athlete, I felt supported by my professors and coaches and was able to excel in both arenas. The hard work and discipline that I learned on the court and in the classroom are values that have served me well," says Kirschenmann, who in the fall was honored as an Outstanding Recent Graduate.

RARE ARE FIN D

How One Fossil Hunter Fueled Paleontology at Mines for Decades

Seventeen miles from campus under a blanket of snow, a stretch of land holds an untold number of fossils and the dreams of a rancher whose passion falls far outside his profession.

Sixty years ago during a visit to a small country grade school in Hermosa, a paleontologist from the School of Mines showed Kenny Brown and his classmates rare fossils from the Black Hills. The young Brown was hooked.

“Did all these animals actually live? Did they live on my place? The first time I found one of those fossils on my land was thrilling,” says

Brown, who at seventy-one years old, continues to volunteer thirty-five hours a week in the School of Mines Paleontology Research Laboratory and who last year bequeathed his 1,330-

acre ranch to the university to further the education of fossil hunters such as himself.

Though his father forbade Brown from pursuing a formal path in paleontology—he was destined to run the family ranch—he did indulge his son’s hobby. When Brown was ten years old, the family ranch was opened to Mines students and faculty who came to look for fossils every few months or whenever Brown stumbled upon a find.

When his father began leasing the land bordering the ranch, Brown discovered the neighbor’s brother was a Princeton paleontologist.

Every summer he would visit his brother, and Brown would skip afternoons at school to scour the hills with him for fossils. The scientist collected over one hundred specimens on



Brown's land, including four different species of *Hesperonis*, a four-foot-tall aquatic bird from the *Cretaceous* period, a rare find in Western South Dakota.

Between SD Mines and the Princeton paleontologist, Brown began amassing a wealth of information through firsthand field experience. He learned to expose fossils and set them in plaster jackets, prepping the finds at night in the barn's heated tack room where he often worked into the wee hours of dawn—divvying the fossils between the two universities while finding respite from ranching demands.

"Whenever I got tired of roping down machinery or calves that were sick, I'd go up there and hunt for fossils. Then everything was okay again."

Those one hundred Princeton finds were eventually donated to the Yale Peabody Museum, and at least 300 others line the shelves of the Paleontology Research Building at Mines, including the one that bears his name.

"I found a twenty-six-foot-long mosasaur, well 90 percent of him—the skull and all the vertebrae. Turns out, it was a brand-new species. A Mines student earned his PhD researching the dinosaur, so he got the privilege of naming it. He named it *Hainosaurus kenbrowni*."

That was in 1999. Today in retirement, Brown spends what is the equivalent of a full-time job prepping fossils in the paleo lab, finally able to turn his first love into his final career.

With infectious enthusiasm, he moves around the lab in a monogrammed white coat showing fossil after fossil, teaching every moment of the way. He rattles off an exhaustive list of technical information for each, from the scientific names of species to the effect of different sediments on fossil preparation and preservation. For those in the know: Bentonite is terrible to work with. Niobrara chalk is a hard yellow soil but perfectly preserves bones.

As part of the curriculum, every freshman class now does fieldwork on his land, led by preparatory and lab manager Kelsie Abrams.

"Kenny's great at field identifications, so the students tend to ask him for help more than me. He knows the fossils on his land better than I do. If he had his way, the students and I would be out on his ranch every weekend. He never gets bored doing fieldwork. His enthusiasm is through the roof, even after all this time. You can tell the education of the students means a lot to Kenny, and he wants to help give them the opportunities he never got," Abrams said.

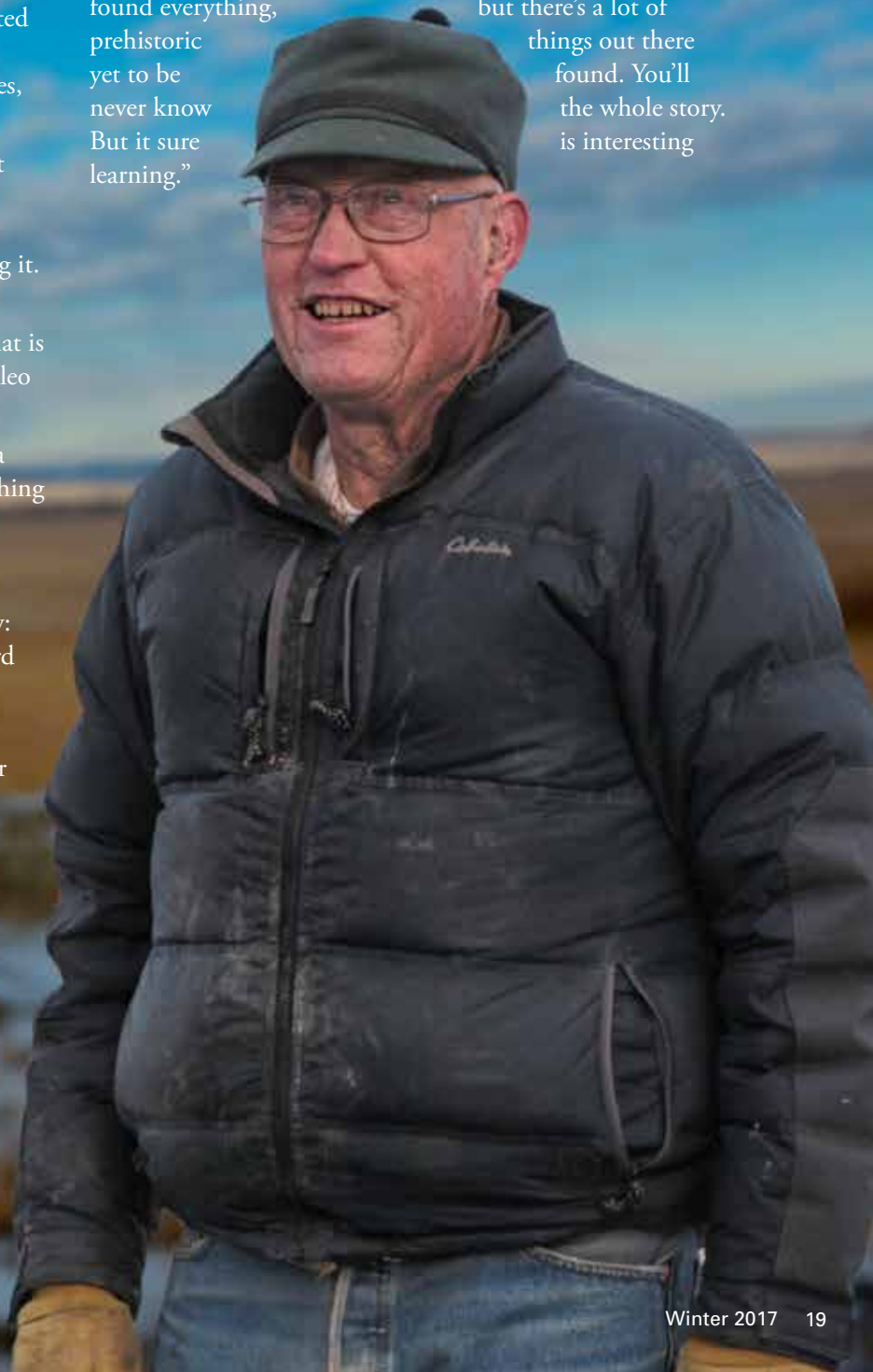
Brown also offers extracurriculars, teaching students how to ride a horse and letting them camp at night.

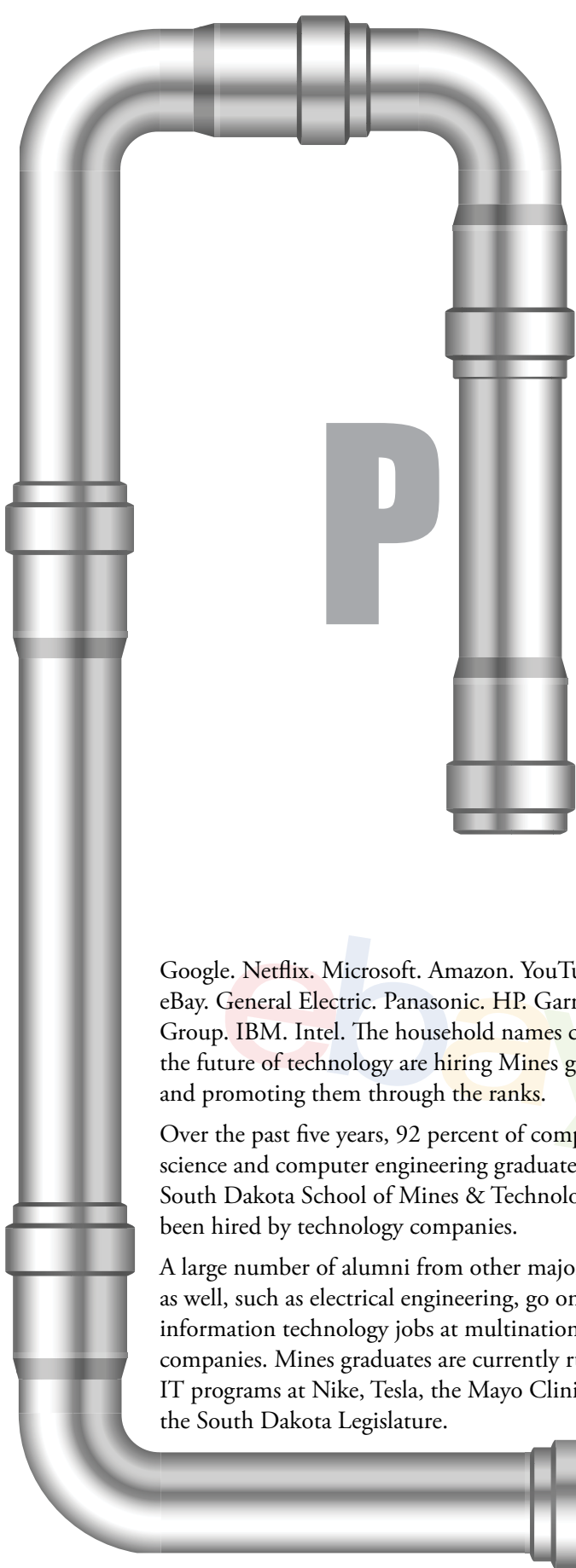
"These kids come out here, and they think they

don't know much. But what amazes me is how much they do know. I tell them, 'You prepare those fossils as well as any professional.' And I try to do what I can with the kids. As hard as they work, they deserve to play a little bit, ride a horse, have an adventure. Some of them have never been out of the big city, and they get out here and tell me they're so thankful to have a chance to fossil hunt. That's worth a lot to me."

His donation to the university includes the fossil-rich exposure to the ranch land itself, which the university can lease or sell to buy whatever equipment is needed.

"Sixty years my passion has sustained for paleontology. You'd think after how many hundreds of years, we would have found everything, but there's a lot of prehistoric things out there yet to be found. You'll never know the whole story. But it sure is interesting learning."





TECHNOLOGY PELINE

Tech Icons Are Increasingly Tapping Mines for New Talent

Google. Netflix. Microsoft. Amazon. YouTube. eBay. General Electric. Panasonic. HP. Garmin. Citi Group. IBM. Intel. The household names charting the future of technology are hiring Mines graduates and promoting them through the ranks.

Over the past five years, 92 percent of computer science and computer engineering graduates from South Dakota School of Mines & Technology have been hired by technology companies.

A large number of alumni from other majors as well, such as electrical engineering, go on to information technology jobs at multinational companies. Mines graduates are currently running IT programs at Nike, Tesla, the Mayo Clinic, and the South Dakota Legislature.

Some of the top employers of South Dakota Mines graduates are iconic industry giants. Microsoft is the largest employer of computer science and computer engineering graduates hired during the past five years and is the third largest employer of graduates from all disciplines. EchoStar, founder of Dish Network, is fifth, and Google is seventh in hiring computer science and computer engineering graduates.

Other top employers of Mines computer science graduates are National Information Solutions Cooperative, an information technology industry leader with facilities throughout the Midwest; South Dakota-based Innovative Systems, Computers Unlimited, CHR Solutions, and Black Hills Information Security.

Whether they work for a Fortune 500 corporation or are employed at an innovative tech upstart, the problem-solving skills students hone during their years at Mines are in demand. STEM jobs are growing at three times the rate of other occupations.

“Mines didn’t just instill all the knowledge I would need to know, but it taught me how to learn. There are many problems in this world that don’t have an answer key, so it’s about knowing how to solve a problem. Mines helped nourish my leadership skills, a good work ethic, determination, and resourcefulness, qualities I continually see from Mines grads,” said Chris Ahlers (CEng 00), a senior engineering lead at Microsoft.

eBay’s Manager of Infrastructure Analytics Randall Newcomb (EE 81) credits his problem-solving skills with the career pivots he’s made, each more impressive than the last. Before eBay, Newcomb had stints at Citi Group, 3M, Gateway, and Seagate.

Today his team forecasts and tracks transactions on eBay, analyzing billions of rows of data with tools that provide insights on how to most efficiently accommodate new features and growth, working closely with the company’s business and finance divisions.

“The basic concepts taught in the software classes continue to be relevant even as software has gone through seismic changes over the past thirty-five years,” Newcomb explains.

In a *Bloomberg* survey of the skills recruiters want most, strategic thinking and creative problem-solving emerged as the two most difficult to find. As for the most important skill? It happens to be the same one Mines alumni cite as the reason they succeed: communication.

“One of the biggest components to being a successful software engineer is the ability to communicate and work with others on a team. ... Mines starts putting

students together on projects as early as their second core programming course all the way up to graduation,” said Hunter Feltman (CSC, EE 15), a software development engineer at Microsoft who works on company projects both in the US and Denmark.

Recent graduate Caitlin Taggart (CSC 16), who interned with Innovative Systems and Computers Unlimited, is now employed as part of Google’s engineering residency program. She’s working with the accessibility team, which helps make the company’s products accessible to people with disabilities, including those who are blind or deaf.

“My favorite thing is seeing how my job helps people around the world. Because Google has such a wide reach, the things I do on a daily basis have a direct impact on the lives of people,” she says. For Ahlers, it’s “managing a team of software engineers whose mission is to empower every person and every organization on the planet to achieve more ... [developing the] software and services for customers that allow them to be more effective and efficient in their jobs.”

The technology pipeline carrying students from course books to careers begins freshmen year.

For Christina Taylor, a junior mechanical engineering major from Rapid City, that meant in a small classroom

learning what at the time was a foreign language: programming.

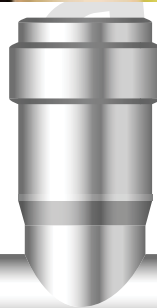
“Since I was homeschooled, I didn’t have labs and had very little information about what engineering was. I read the entire Mines catalog twice and narrowed my choice to mechanical engineering because I was interested in robotics, like the kind used in prosthetics,” Taylor says.

Realizing she also needed coding experience to move forward in this career path, Taylor began taking

computer science courses. Last summer she interned at Google in California, collaborating virtually with coders from Switzerland to the United Kingdom. She will return this summer for another internship.



Christina Taylor, Google



Taylor also joined the university's highly regarded programming team. One of the Mines three-member teams recently qualified for the World Finals. It will be the seventh time the university has been represented on the world stage.

Indeed, Mines' reputation for repeatedly sending the best student computer programmers to compete against the world's elite at the International Collegiate Programming Contest is what helped Rapid City land this summer's event.

The 2017 world finals hosted this May in Rapid City marks the first time the contest will be held on US soil in over a decade, further highlighting Mines as an incubator of the next generation of computing talent.

"Mines has a great reputation in computer science, robotics, and computer engineering," said university President Heather Wilson. "That reputation was earned by exceptional faculty over many years."

Like Taylor and Taggart, many students have multiple internships. Mines' partnerships with industry helps students apply their coursework in real-work settings.

Dan Andrus (CSC 16) interned at 7400 Circuits in Rapid City—a small company in the Black Hills Business Development Center—and now works at YouTube in Silicon Valley. Hayden Waisenan (CSC 13), who had internships at EchoStar, L-3 Communications, and Innovative Systems,

is now employed fulltime at Amazon.

Mines grads are in demand in part because of skills gained on the job, says Assistant Vice President of Student Development Darrell Sawyer, who directs the internship program and Career Center and tracks placement rates and starting salaries.

"Mines is becoming more well-known in the computing sector for a number of

reasons—programming competitions, the willingness of key alumni to be internal advocates, and the quality of our students. Plus, there is a strong demand in many industries for programmers and software developers," Sawyer says.

In addition to internships, Mines coursework is focused on practical application of knowledge. "Many college programs focus exclusively on programming at higher levels of

abstraction. The way Mines emphasizes core computer science concepts with a focus on low-level details has been critical to my success," says Chris Rudolph (CSC 08), a senior software engineer at Microsoft.

This technology pipeline feeds beyond entry-level. Alumni serve at the helm of multinationals, too, including Sanjeev Addala (ME 89), chief digital officer at GE Renewable Energy, and Rich Schmidt (CSC 88), IT transformation director at Shell in Texas.

Ahlers, a senior engineering lead at Microsoft, points out that in this day and age every company is a tech company. "Consider agriculture, for example, and what people are now able to do that they couldn't do ten or even five years ago. Technology is pervading all industries, which only increases the demand for individuals well-educated in STEM."

Susan Opp (EE 85) is sector president of Space and Power Systems at L-3 Technologies, helping lead one of the nation's top ten defense contractors.

Providing communication systems—including airborne intelligence, surveillance, reconnaissance, and space systems—L-3 serves the Departments of Defense and

Homeland Security, NASA, commercial customers, and aerospace contractors like Boeing and Northrup Grumman. Under Opp's watch, L-3's Communications Systems West has doubled its business and its employees from



Chris Rudolph, Microsoft



Susan Opp, L-3 Technologies

about 2,000 to about 4,000 people during a five-year span.

"The quality of the education for the tuition paid is a fantastic value proposition. Don't underestimate the assistance you'll receive from the Career Center—they are committed to finding you that internship or entry-level position that will jumpstart your earning potential. Many engineering schools don't have this level of connections or commitment to their students' success," she says.

Opp's advice to current students: "Believe in yourself. A graduating student from SD School of Mines can and will be able to compete with anyone in the country."

Mines Research Converts War Zone

Waste into Energy

for Air Force

More than halfway through a four-year \$4.8 million project for the United States Air Force, South Dakota Mines researchers have successfully turned wood and waste products into diesel and gases, built manufacturing-scale reactors, and filed multiple invention disclosures for patents.

The Air Force is mandated to transport all waste generated in hostile environments off site after ceasing operations, a costly endeavor. South Dakota Mines chemical and biological engineering researchers are working together to develop several technologies to save energy and dollars by eliminating the need for off-site transportation.

Rajesh Shende's research group has built a reactor that produces diesel-like fuel from wood and waste products and enables the Air Force to reduce solid waste by 80 percent. Ultimately, up to one ton per day of mixed solid waste will be turned into diesel for base operations through a conversion technology known as hydrothermal liquefaction. The system will be installed on a tractor-trailer for easy transportation in and out of forward operating bases.

Rajesh Sani's team has developed an ecofriendly process to manage and completely dispose of food waste, an ever-increasing problem. The process is capable of converting raw untreated complex waste into ethanol without expensive or time-consuming steps. Eliminating the pretreatment step has reduced energy consumption by 15 percent. Preventing

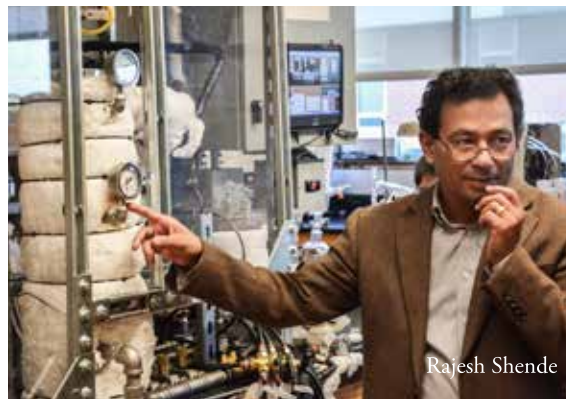
the washing step usually required after pretreatment has reduced water consumption by as much as 50 percent. This breakthrough has resulted in the production of the highest concentrations of ethanol compared to other tested non-pretreatment technologies.

Patrick Gilcrease's group has developed a separate biological process to convert food, cardboard, and sewage wastes into combustible methane gas to generate heat and electricity.

Novel aspects of the design include simultaneous processing of mixed waste streams and downsizing state-of-the-art anaerobic digestion technology to fit on a transportable truck skid. Local engineering firms Litzen Process Consulting and Schultze Engineering are nearing completion of the skid-mounted prototype, and initial field trials will soon be conducted at the Rapid City Wastewater Treatment plant.

Todd Menkhaus' research group has developed innovative nanofiber membrane materials to improve a water purification process, dramatically reducing energy and water consumption at bases. The Mines process allows better rejection of particles and contaminants and has been shown to use 80 percent smaller filtration modules for the same amount of clean water than current coarse units, with longer lifetimes and operational cycles.

Other projects include solar-thermal photovoltaic hybrids that would reduce the amount of liquid fuel needed on bases.



Rajesh Shende



SINCE



2012

CONCEPTION TO CONSUMPTION

• RAPID CITY, SD •

Alumni Bring Craft Beer to the Black Hills

It started in a garage, like many great companies do.

A brewhouse, a couple of fermenters, five to six hours per batch, and a willing clientele of family and friends.

The brainchild of beer aficionados, Hay Camp began as the hobby of two graduate students attending South Dakota Mines. Sam Papendick (PhD CBE 15) was pursuing a PhD in chemical engineering. Karl Koth (MS Geol, GeolE12) was working on a master's in geology and geological engineering, with a fulltime offer from the United States Geological Survey (USGS). Combined, they had a decade of home brewing experience, stretching back to the days of their bachelor's degrees.

Soon the pair was producing batches every weekend. That's when they decided to turn craft beer into their next career.

In the five years since, they have placed third in the Governor's Giant Vision Student Business Competition, launched a successful brewery, and recently expanded their company's operations.

The cash prize Papendick and Koth won from the business plan competition in 2012 provided the capital needed to purchase equipment, file as an LLC, and begin hunting for the perfect initial spot to serve their small-batch, hand-crafted ales.

Transforming a former creamery's mechanics garage into an industrial-meets-historical taproom, Hay Camp opened to the public in January 2014 in a renovated space east of downtown.

The combined bar and brewery was a 1,000-square-foot space with long, rough-hewn tables and was often packed.

Papendick and Koth control the entire process from conception to consumption, serving beer at its peak, anywhere from five weeks after it's brewed up to a year later, in high-end glassware at 42 degrees instead of the traditional 38, the pair say. The higher temperature enhances the flavor and aroma.

Critics agree.

The first year out, *The New York Times* profiled Hay Camp for its feature "A Renaissance in Rapid City." The second year, *Food & Wine* hailed it as one of the "50 Best Nanobreweries in the US," followed by *Yahoo! Travel*, which slotted the startup as one of the "50 Best Breweries in the States."

In two years, Hay Camp went from Fridays-only to five days a week, with mounting demand. When the lease came up in 2016, they knew it was time for a move.

Papendick and Koth traded their digs for a new 37,000-square-foot building last spring—with plans for every inch. The new location at the corner of Kansas City and Sixth streets is a few blocks west but still near the heart of downtown. The space is outfitted for live shows, a small restaurant, self-storage, underground parking, a drip coffee bar featuring a variety of local roasters, and, of course, the brewery and pub.

After graduating with his doctorate in 2015, Papendick taught in the Department of Chemical & Biological Engineering and joined CalxAqua, a Mines startup producing limestone-based

media that removes arsenic from drinking water. He helped scale-up production and move product from the lab to the marketplace. Papendick says being involved in all aspects of CalxAqua, from chemical engineering to product-market fit, is a natural extension of what he's done at Hay Camp.

Like former faculty member Papendick, Koth left his job with the USGS to pursue Hay Camp full-time.

The entrepreneurs see untapped potential as Hay Camp carves out its niche in the gap between product,

distribution, and demand. South Dakota is fourth nationwide in beer consumption and eighteenth in breweries per capita. Yet in craft beer volume produced, it's dead last.

"This is the kind of entrepreneurial activity we love to see," said Mines President Heather Wilson. "I'm glad Sam and Karl are staying in South Dakota and growing their business."

The new Hay Camp will celebrate its grand opening in February.

"There is lots of potential for economic development for South Dakota, from agriculture to brewing, production, and distribution. I want to keep South Dakota dollars in South Dakota. Right now, 99 percent of the beer consumed in the state comes from breweries outside the state, so every time you buy a beer, that cash is essentially lost. We're fourth highest in beer consumed, but we don't make a lot of it," Papendick says.

With Hay Camp clearly on the upswing, Papendick and Koth hope to shift that ratio from consumption to production.



Sam Papendick and Karl Koth review construction plans.

FIREWALKER

Unique Rover Built at Mines Takes Geologists, and Possibly One Day Astronauts, To New Surfaces for Research

With its sleek white exterior, gold foil-encased radiation detector, and antenna spiraling into the blue sky above, the Firewalker rover seems more futuristic than field-hardened. But Firewalker lives up to its name—field-tested in Hawaii where the Kilauea volcano's lava pours into the Pacific.

Firewalker holds potential beyond volcanic data collection. It can help Border Patrol detect tunnels, locate underground facilities storing weapons of mass destruction, or find fossils for paleontologists.

This versatility stems from Firewalker's revolutionary automation of gravity measurements. Before, the state-of-the-art method was measuring by hand.

Gravity is a function of mass, meaning dense objects like magma or tunnels



appear as gravity anomalies beneath our feet. To detect these data blips, researchers must use a gravimeter, a bread box-sized instrument painstakingly hand-leveled with screws before each measurement is collected—at pre-selected areas hundreds of meters apart, as only a handful can be recorded during daylight hours.

Firewalker's innovative technology looks to make the job easier for geologists in the field.

The rover has a cable plugged into the gravimeter, connecting the instrument to a computer that remotely commands it to move to a site and level itself in seconds through tiny motors, recording hundreds of measurements a day. Firewalker also employs information optimization theory, so as each measurement is taken, the computer figures out where best to get the next recording, accruing not only more, but better, data.

While not designed to crawl on top of active lava flows, the rover can get far nearer to volcanoes than people can, impervious to hazardous gases or hot temperatures. It can also operate in remote areas, radioactive hot spots, or any condition too hostile for humans—all safely autopiloted from a remote desktop.

But this gleaming feat of ingenuity didn't emerge on day one.

The initial shoebox-sized prototype caught the attention of Mines faculty researchers Tim Masterlark, PhD, and Nuri Uzunlar, PhD, both from the Department of Geology & Geological Engineering, as it roved autonomously around the campus Quad. Impressed by the proof of concept, they gave its creator, geology doctoral candidate Theodore Donovan, funding to take the next step.

For Donovan (PhD Geol 16), that meant getting together a team. He asked a small group of students at Stevens High School who were passionate about computer-aided design to 3D-print sensor mounts. Now the team has grown to

twenty students learning to build and program entire robots, mentored by an undergraduate geology student, Jared Fox, who himself is mentored by Donovan.

In six months Donovan took Firewalker from development to deployment. Working nearly seven days a week, he outfitted Firewalker with a 3D-printed, waterproof, gas-proof, and chemically resistant casing of his own design. He programmed the camera to move independently of driving direction. He developed a rover antenna that connects with an antenna on his computer, one which ensures Firewalker never loses a signal or has a delay in its video feed.



Theodore Donovan, Dr. Tim Masterlark

Donovan's dissertation focused on Alaska's Okmok volcano, developing models of magma chambers, which could lead to earlier predictions of eruptions.

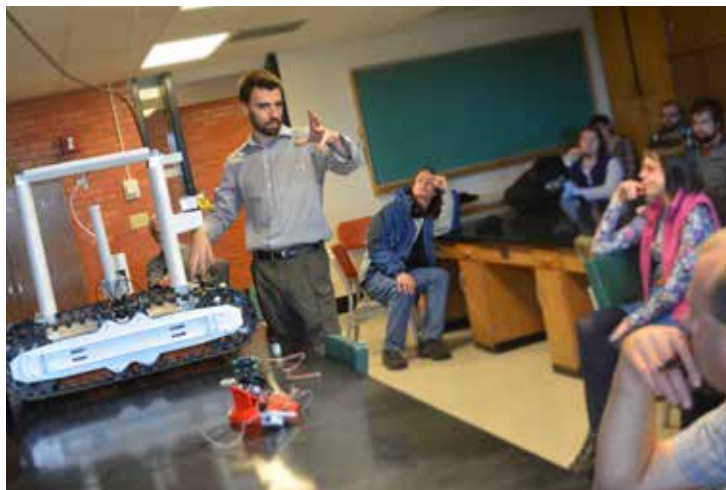
"The hallmark of PhD research is an ultrafine focus. Ted has the ability to look beyond his dissertation to see where else he can apply his knowledge. Generally, robotics is the field of engineering. But geophysicists also need information collected by these devices, whether by satellite or rover. Ted applied

his knowledge on the science side and learned the engineering side, and that will make him a formidable candidate for whatever career path he chooses," says Masterlark.

Masterlark hopes to continue the project and eventually pitch it to NASA for a

future-generation Mars rover. But even more so, he hopes the rover will overturn stereotypes.

"With geology you think of rocks, but it can also be robots and satellites taking images of every square inch of earth. This is how science in the twenty-first century is conducted."



AMAZON research

Laurie Anderson Explores How Marine
Clams Found Their Way Into one of the
World's Largest Rivers

Dr. Laurie Anderson photographed these images from the Amazon, with the exception of the two photos of Anderson (top and left center opposite page), which are courtesy of Mark Siddall, American Museum of Natural History.

The Amazon River is teeming with life, from solitary four-hundred-pound catfish to shoals of eight-pound piranha. But in the Amazon basin around Santarem, Brazil—where white water, clear water, and black water rivers pool together—it's the ancient tiny mollusks that have captured the attention of Mines researcher Laurie Anderson, PhD.

The three distinct water types collect here to create a uniquely rich breeding ground for extreme aquatic life in one of the world's largest rivers.



a team of thirteen senior researchers from five countries. Anderson is co-principal investigator. Thorough species inventories of sponges, flatworms,



annelids, mollusks, crustaceans, and fishes will result in large collections in premier natural history museums. The research will also produce species description and taxonomic revisions; online and printed guides to the aquatic macrofauna; a guide book to fishes of the lower Amazon; a detailed plan for the long-term monitoring of aquatic diversity in floodplain and forest stream systems; and

a Tropical Biodiversity Field Course for US and Brazilian students.

Geologically speaking, the Amazon's current course is a relatively recent phenomenon, she says. Tens of millions of years ago the river drained to the north into the Caribbean.

While the Amazon itself is a white water river, the Brazilian basin where the team has been conducting research is effectively a giant nutrient-rich lake where the clear water Tapajos River and the black water Arapiuns Rivers join. "The Amazon Basin is known for having a number of taxa that we typically think of as marine inhabiting freshwater. This includes my clams but also dolphins, sting rays, needle fish, etc.," Anderson says.

Eleven million years ago the western Amazon Basin was a large series of wetlands that saw the diversification of several lineages of mollusks, including the Corbulidae, says Anderson, who has published prior research about these clams.

"I am now using the new collections from Brazil to get molecular data to place members participating in this radiation in the evolutionary tree for the family. This marine family has freshwater representatives also in Australia and Asia, and my colleagues and I are trying to determine if these taxa represent a single branch of the evolutionary tree or if members of the family invaded freshwater multiple times in their evolutionary history," Anderson says.

Anderson's research interest is in a little known genus of typically saltwater Corbulidae clam from the last member of a once diverse radiation in the western Amazon.



She has devoted much of her career to studying this clam and other family members in the fossil record, and her current research continues to explore its evolutionary track.

Anderson, who is also the head of the Department of Geology & Geological Engineering, spent three weeks during the fall living on a boat in the Amazon Basin, collecting aquatic specimens for a National Science Foundation-funded survey on aquatic faunal of the lower Amazon. It was the second such trip she participated in for this comprehensive survey of freshwater macrofauna (larger invertebrate and fish) by





Distinguished Alumni honored at the December commencement ceremony were, from left, Susan Opp, Dale Bryson, John Rathbun, Bob Glodowski, and Mary Himmler.

GLOBAL ENGINEERING AND SCIENCE LEADERS HONORED AS DISTINGUISHED ALUMNI

The 2016 Distinguished Alumni Award recipients join an elite group of ninety-two other graduates who have been honored since 1998 for their outstanding contributions to engineering and science.

Dale Bryson (CE 61) has spent his entire career as a public servant in the field of environmental protection, most of it with the EPA. He was designated to lead an international team to review water pollution, drinking water, and wetlands protection programs. His work has helped develop policies to abate the use of toxic chemicals in water systems worldwide. President Clinton awarded Bryson a Presidential Rank Award for meritorious executive service.

Bob Glodowski (MetE 67), sole proprietor of RJG Metallurgical, LLC, is recognized as a world leader in the

science and technology of steels and alloys. He has earned two patents and has authored hundreds of technical publications. He continues to focus on setting standards for the steel industry. In 2002, Glodowski received the prestigious Mordica Award, recognizing one individual worldwide for wire and cable industry contributions.

Dr. Mary Himmler's (Chem 88) professional focus is providing care for severely injured service members and veterans. She received her Doctor of Medicine degree from the University of South Dakota and is currently the medical director for Traumatic Brain Injuries at the Minneapolis VA Medical Center and associate professor at the University of Minnesota School of Medicine. Prior to that she served as chief of inpatient rehabilitation at the Walter Reed Army Medical Center in Bethesda, Maryland.

Susan Opp (EE 85) is sector

president of Space and Power Systems at L-3 Technologies, which provides communication systems for the Department of Defense and other government surveillance, reconnaissance, and airborne intelligence collection systems. During her thirty-year career she has led organizations up to 5,000 people and has re-invigorated the culture to grow revenues and profits.

John Rathbun (MineE 84) is president of Austin International, Inc., in Cleveland, Ohio. The company runs operations in over twenty countries in Latin America and Europe with sales in another eighty countries. Under his watch over the past twelve years, company revenues have increased on average over 20 percent annually with an even greater growth in profits. John has served on the university's Mining Engineering & Management Industrial Advisory Board, sharing his expertise to rebuild the program in the 2000s.

1950s

John Hetlinger (Chem 55) notes after “America’s Got Talent” auditions, he sang onstage with rock metal band Drowning Pool at the Chicago Open Air Festival and at the Ink in the Clink (tattoo) Festival at the old Ohio Reformatory in Mansfield, Ohio. John, who is nearly eighty-three-years-old signs off as eighty-two-year-old Grandpa Rocker. He performed Drowning Pool’s signature song “Bodies” with the heavy metal band at Colorado Springs, Denver, and other cities on the band’s “Not-so-Silent Night” tour in December.

Ed Peacore (EE 58) walks two miles a day and is doing well with Parkinson’s. His three grandchildren are in undergraduate and graduate schools.

Willard Potter (CE 57) is proud to say his grandson, Logan, son of **Darla** (CE 92) and **Lee** (CE 87) Potter, will be a freshman at SD Mines this fall.

Leroy Solid (ME 59) notes the National Robotics Mining Competition was held at Kennedy Space Center last May. There were forty-seven major engineering schools there. He thoroughly enjoyed spending time with Dr. Jason Ash and the SD Mines team members, calling them an impressive group of engineers.

James Stillman (ME 55) has been taking road trips since his wife died three years ago.

This past year he has been spending time with an old high school classmate in Lexington, Kentucky. He notes he is still in good health and wonders if there are any Mines alumni near Lexington.

Richard Stone (GenE 56) has been retired for twenty-one years and consulting along the way. He says he appreciates his education from Mines.

1960s

Sidney E. Clark (CE 61) passed away September 4, 2016, in Friday Harbor, Washington. He earned a master’s degree in sanitary engineering from the University of California, Berkeley, while serving in the US Public Health Service. His career was spent in the field of wastewater treatment, and he held six patents in wastewater treatment processing. Sid was a registered professional engineer in Washington, Alaska, and Oregon. He is survived by his wife of fifty-five years, Susan, three children, and six (soon to be seven) grandchildren. Sid always credited SD Mines for an education that enabled him to enjoy a successful career. Condolences may be sent to: P.O. Box 129, Friday Harbor, Washington, 98250.

Michael Leibbert (ChE 69) retired from ExxonMobil last year, enjoying globe-trotting and living in Houston, Texas.



Bob Miesen (CE 61) has been enjoying time meeting with former alumni, such as **Larry Blair** (CE 60) in New Mexico, pictured in this photo, and traveling abroad.

Daniel Moszer (ME 69) married Tatyana Batalova of Peam, Russian Federation, last December.

Wayne Sutherland (GeolE 60) says he is enjoying his retirement in Boise, Idaho. Boise is booming, with a population that has quadrupled since he moved there in 1980 to join **Carl Strande** (GeolE 61) at Morrison Knudsen. He says the pair built exciting projects from Valdez to Brazil.



Marshall R. Thomsen (EE 65) retired in 2003 as a geophysicist. He and his wife, Carrie, live in Hot Springs Village, Arkansas. They have a combined family of eight children and seventeen grandchildren and recently celebrated their twenty-sixth anniversary. The village offers nine golf courses and a lake, which they take advantage of often.

1970s



Carmen Adams (ChE 75) says life has been moving fast this year, including volunteering for Tax Aide for seniors, trips to the Galapagos and Panama for snorkeling, driving trips to visit SD Mines, family, friends, and the great National Parks of southern Utah. When home, she spends her winter days skiing and summer days golfing in Northwest Montana.

Jeffrey Allen (ChE 77) retired from Caterpillar, Inc., on February 1, 2016, after a thirty-eight-year career. He has been enjoying working on the many small projects he never had time for before retirement. He and Jean attended her forty-year Central High School reunion in July and have begun looking through the Black Hills for a retirement home.



Dave Berg (ME 73) was inducted to the Baltic High School Hall of Fame in September 2016. In the late 1960s he was named an All-State football player his junior and senior years and was named All-Conference three years. Dave also was a four-year letter winner in track, a two-year letter winner in basketball, and was named All-Conference in basketball his senior year. He also lettered in both band and chorus and was student council president. At Mines he was a rare two-way football player and was named SDIC All-Conference his senior year. Dave, his wife, Bonnie (Schoon) Berg, and a partner started an engineering firm in Rapid City that grew to fifty-six employees with four offices in three states.



Allan Bergeron (EE 74) and his wife, Liz, spent twenty days in Africa in October 2016. They stopped at Victoria Falls, Zimbabwe, the Duma Tau camp in Botswana on the Linyanti River, Cape Town in

South Africa, and Thornybush, a private game reserve in South Africa adjacent to Kruger National Park. Their favorite part of the trip was a cheetah named Sylvester, which was raised by humans after being orphaned. He is now a camp ambassador near Victoria Falls.

Gary Brown (GeolE 72) notes they finally sold their house. Thirty-three years ago he started his business, The Examiner, in a spare bedroom. He is now wrapping up the fourth version of his software and hopes to sell the business next year. His wife is in her twenty-first year teaching at a charter school in Minneapolis that serves the Somali immigrant community. Summer travel sees them in a sixteen-foot Scamp fiberglass trailer. Twin Cities' folks should drop in at the Minnesota Music Café, east side of Saint Paul, on the third Tuesday of each month to catch the big band he plays in.

Paul Ching (MS GeolE 73) started a new oil and gas company in 2014. He purchased the first oil and gas field in February 2016 and is looking for additional assets to acquire. He has seven grandchildren ranging from thirteen-years-old to three weeks.

Ray Dennis (CE 77) is currently working in China for Westinghouse, supporting the pre-operational testing for Units 1 and 2 of the Haiyang Nuclear Power Plants in Shandong province. Construction of Units 3 and 4 have started.

Units 5 and 6 are being planned. The plants will be operated by the Shandong Nuclear Power Company. He can be reached at ray.235@hotmail.com. He was able to visit campus almost twenty years ago and show off the campus to the children.

Jeff Dietz (CE 72) has been fully retired after forty-three years with CB&I. **Henry Mott** (CE 73) gave him a badly needed golf lesson now that he has had time to learn and play. He does not know many other Mines graduates in the Minnesota area. They welcome those and others who might pass along the way.

Joel Grace (MinE 73) formed Grace Consulting Services, Inc., in 2004 specializing in project management. He has been working as a project/construction manager for numerous large mining companies for the last twelve years and has worked on numerous crushing and conveying systems, truck shop expansions, railroad loop construction, and the partial remediation of a 1941 aluminum plant. He is ready to retire, relax, travel, and spend more time with four granddaughters. He and his wife, EttaAnn, live in Cheyenne, Wyoming, and look forward to the next all-school reunion.

1980s



Lynne Victor Bukovic (ChE 87) and **Kurt Selzle** (ME 86) were recently recruiting for Mines at a national college fair in St. Louis, Missouri. They have been working for several years in the area with local high school guidance counselors and at local college fairs to spread the word about Mines. According to the university's admissions office, the number of applicants from the area has increased.

1990s

Sean Horton (GeolE 90) is in the Bellingham, Washington, area after moving there over eighteen years ago. He is working at the Phillips 66 Ferndale Refinery as a project engineer. His daughter graduated from the University of Washington as a Husky last summer and married her husband, Sam, a few days later. He would love to see any old classmates passing through his area.



Paul (ME 93) and **Amy Larson** are thankful for all God's blessings. Their oldest son, Caleb, graduated from high school and is doing a discipleship training school with Youth With a Mission. Here is a picture of their youngest child, Eden, with their Great White Pyrenees puppies. Paul continues to work at Metropolitan Industries as general manager. Amy is busy with the family's nine children and homeschool teaching. Seth just got his driver's permit.



Randy Yuill (EE 74) and **Randy LaRoche** (ME 97), two engineers employed by Siemens Energy Inc., on a project at Coughlin Power Station in St. Landry, Louisiana, graduated from South Dakota Mines decades apart. They have traded many memories of their time on campus.

2000s



Kyle Carey (CE 16) and **Laeken Stugelmeyer** (CE 16) had a fun hike in the Colorado Rockies.



Audra Mullet (ME 91) and her daughter, Brenna, at the thirtieth anniversary of the ADPi Chapter at SD Mines. Brenna is a current student.

Dean Henderson (IS 03) is developing homes and neighborhoods for people fifty-five and older.



During their immersion week in Shanghai, **Tamara (Monson) Hughes** (EE 91) and **Fanar Sefa** (ChE 08) took a moment to show off gear from their two favorite universities: SD Mines and Rice University. Tamara and Fanar discovered their common ties to Mines when they met on their first day of class in 2014 in the Executive MBA program at Rice. They successfully completed their MBAs in May 2016.

Kimberly Laughlin (IE 10) just got a new job at Puget Sounds Naval Shipyard working for Carrier Team One knowledge sharing network to improve deckplate processes. She will be working for **Matt Van Ravenhorst** (CE 02).



Ashley Leger (GeolE 16) earned her PhD in May. She is the lead paleontologist for the new subway expansion project in Los Angeles, California. Her doctorate studies dealt with mammoth skulls, and the first vertebrate fossils discovered at the new subway project were both proboscideans (elephants). This story has received much media coverage in California.

Erin McCullough (MinE 14) graduated from Virginia Tech with a master's degree in mining engineering in May 2016 and has been employed as an analyst for the US Department of Interior near Washington, DC, since. She collaborates with multiple government agencies to minimize national security risks associated with potential disruptions of international mineral supply chains.



Valeri Eisenbraun (IS 09) and **Michael Grave** (ME 09) wedding photo with all the SD Mines alumni who were present to help celebrate their marriage.

IN MEMORIUM

**The names below include those who have passed in the last three years but
who were not listed in a previous *Hardrock* issue.**

Maynard Raasch (ChE 37) 3/23/15	Rod Meador (CE 56) 1/10/16	Walt Cameron (EE 73) 3/8/15
John Trantina (Geol 38) 1/11/14	Bill Coleman (MinE 57) 11/5/14	Darrell Hoyer (GeolE 73) 4/22/15
Perry Beka (CE 43) 1/13/15	Robert Schmidt (MinE 57) 2/13/16	Douglas Drake (CE 74) 10/26/16
Eugene Bender (EE 43) 5/21/14	Stanley Spring (GeolE 57) 2/9/14	Steve Parker (Math 74) 9/23/16
Ken Hall (MetE 43) 6/10/15	Delmer Brown (GeolE 59) 12/12/16	Terry Hertel (Chem 75) 6/28/16
Stewart Romans (GenE 43) 12/1/16	Roland Harris (ME 59) 11/26/14	Joe Jagodzinski (CE 75) 11/19/16
Bob Winkler (CE 43) 6/21/16	Orval Meier (EE 59) 3/16/15	John "Jack" Klube (MS Chem 76) 5/14/15
Lloyd Darnall (CE 44) 9/10/16	David Riesland (EE 59) 7/8/16	Robert Rowe (MetE 76) 11/10/16
Gene Wingert (ChE 44) 1/3/15	Gene Turechek (EE 59) 4/23/16	Lew Rabenberg (MetE 78) 11/18/16
Dave Robertson (EE 46) 1/31/14	Tom Gorder (MetE 60) 9/27/16	Alan Wilhelm (MS MinE 78) 6/30/14
Ralph Henry (MinE 47) 10/19/14	John "Jack" Gibeau (ME 60) 7/14/16	Randy Withee (CE 78) 8/23/16
Warren Finch (GeolE 48) 7/21/14	Conrad Bowman (MetE 61) 11/20/16	Bill Cameron (ME 79) 2/7/14
Marvin Heck (CE 48) 10/21/16	Sidney Clark (CE 61) 9/4/16	Casey Chord (EE 79) 8/7/14
Norman Menyuk (Phys 48) 2/12/16	Doug Devine (CE 61) 9/6/15	Dave Bradley (EE 80) 9/6/16
Neil Chauncey (CE 49) 9/25/15	Mike Ellwein (ChE 61) 7/31/16	Paul Jensen (MetE 80) 6/2/14
Fred Beeman (GeolE 50) 1/8/17	Marlyn Hanson (CE 61) 10/2/14	Paul Hohn (MinE 81) 8/21/16
Lynus "Pat" Ryan (CE 49) 12/8/16	Bert Miller (ChE 61) 7/7/14	Kevin Crago (ME 82) 12/7/16
Norman Hart (ME 50) 6/28/14	Samuel Allen (CE 62) 11/17/14	Robert Pierce (CE 82) 5/19/14
Earl King (CE 50) 9/30/16	William Jonas (CE 62) 3/20/14	Greg Comes (CE 87) 4/5/16
Darrel Boyd (GeolE 51) 12/1/15	Ron Kostelecky (MS Phys 63) 5/10/15	Michael Hynes (MS MinE 87) 10/7/14
Oliver Willert (CE 51) 3/25/16	Clarence Lemley (EE 63) 11/3/14	Tim Johnson (EE 89) 8/11/16
Louis Martin (GeolE 52) 4/10/15	Larry Anderson (ME 65) 1/16/14	Ronald Rylander (CE 90) 8/1/14
Bill Tift (GeolE 52) 2/7/14	John Gale (EE 65) 8/29/16	Ruth Ziolkowski (HON 91) 10/8/14
William Willging (GeolE 52) 11/9/15	Gary Barber (ChE 66) 7/5/15	David Daly (ME 92) 6/1/15
Leon Estes (GeolE 53) 2/26/16	Galen Smolik (MetE 66) 6/26/16	Bill Burkhart (MS TMGT 93) 6/12/14
Walter Johnson (GenE 53) 1/21/16	Richard Wadleigh (GeolE 66) 3/31/15	Barry Jones (IS 98) 1/13/15
Tony Just (ME 53) 11/5/15	Wu-Wey "George" Wen (MS MetE 66) 9/16/15	Thomas Kalla (CSC 99) 4/9/16
Bob Thune (EE 53) 1/21/16	"Butch" Brown (ME 67) 6/17/14	Troy Beck (CEng 00) 3/25/16
Ralph Tice (EE 53) 10/14/14	Dennis Tiede (ME 67) 8/3/16	Shelly Schock (IS 00) 8/14/16
Doran Wara (ME 53) 9/27/16	Marc Bandhu (EE 69) 2/10/15	Jim Bauer (HON 03) 11/18/16
John "Jack" Barger (EE 54) 11/9/14	Jerry Kinsley (ME 69) 3/20/14	Joshua Dodd (EE 15) 9/27/16
Eugene Anfinson (ME 54) 7/5/16	Ken Luza (MS GeolE 69) 7/23/14	Former Faculty/Staff
Richard Larson (EE 54) 3/14/15	Micky Crandall (CE 70) 10/26/15	Richard "Dick" Fedell 7/13/16
Bob Smith (EE 54) 10/26/16	Jon "Cy" Hill (ME 70) 9/6/16	Ziggy Hladysz 8/12/15
Ed Wictor (GeolE 55) 2/7/14	Lee Rice (MS Geol 70) 8/20/14	Paul Lupkes 5/31/16
Jay Brink (EE 56) 2/20/15	Steven Davis (Math 71) 12/6/15	



1: Tyler Artz (MinE 15), James Williams (current student), Andrew Uttecht (current student), Shane Lee (MinE 10), and Greg Hintgen (EE 99) of Triangle Fraternity at their annual Faculty Christmas Party.



2: Keith Beck (EE 90) and several Theta Tau alumni gathered on Lake Oahe at South Whitlock Resort for fishing fun on June 10, 2016. Pictured left to right are Don Lapp (ME 92), David Hartmann (CE 94), Sterling Greni (ME 08), Jay Blomster (ME 04), Shawn Klabunde (EE 90), Andrew Durbin (CE 98), Glen Wilcox (ME 90), Kevin Erdmann (ME 04), Lorne Lawrence (Ex 89), Shon Anderson (Ex 93), Marty Jackley (EE 92), Keith Beck (EE 90), Jesse Robbenolt (ME 09), Ben Grassel (ME 13), Nick Phillips (CEng 99), Randy Ringstmeyer (CE 02), Sam Berta (CE 98), Darin Hodges (CE 98), and Jim Soulek (Chem 00).



3: The SD Mines Milky Way canoe team placed thirteenth out of twenty-one teams at the National ASCE competition in Tyler, Texas, June 9-11, 2016. Several SD Mines alumni were there to cheer on the team and enjoyed spending their day watching the races. Spectators and participants shared an adrenaline rush when a four-foot-long snake joined the race. The team sends their thanks to all alumni supporting them at the event and from afar. Pictured: The SD Mines Concrete Canoe Team 2016, with alumni support from Becky and Bob Miesen (CE 61), Reah Dahl-Stamnes (CE 81), Jackie and Lon Denison (ME 64), grandparents to team co-captain Sam Sorger, and Daniel Lee (CE 62).

4: Libby and Greg Hintgen (EE 99) hosted a Halloween party to celebrate Chuck Cox's fortieth birthday. It was a great gathering, and most were part of the Mines alumni family. Alumni from the left Kameron (IE 03) and Dianna Williams, Greg (EE 99) and Libby Hintgen, Ben Dines (MetE 97), and Lars (CE 02) and Jessica Anderson, with Chuck Cox (ME 00) in front.



5-1, 2, 3: ADPi celebrated its thirtieth anniversary on the SD Mines campus. Jade Herman (IS 09), Ashley Johnson (IE 09), Amy (Thorbjornsen) Kress, Audra Mollet (ME 91) Diana (Elrod) Peninger (ChE 86), Ann (Severson) Tuohy (ChE 89), Angie (Schofield) Stucker (ChE 89), Monique (Hoffman) Kramer, Joyce Kovacs (GeolE 90), Elaine Petry (Chem 14), Tyanna Langer, and current students.



Christie (Welk) Ingalls (CE 92), Amber Jerke (ChE 10), Melanie Jeppesen (IS 09), Audra Mollet (ME 91), Gabrielle Iverson (IS 13), Alica Kunz, Elaine Petry (Chem 14), Jade Herman (IS 09), Joyce Kovacs (GeolE 90), Angie (Schofield) Stucker (Chem 89), Diana (Elrod) Penginer (ChE 86), Ann (Severson) Tuohy (ChE 89), Monique (Hoffman) Kramer, Ashley Johnson (IE 09), and current students.



From left to right, back row: Christie (Welk) Ingalls (CE 92), Ann (Severson) Tuohy (ChE89), Amber Jerke (ChE 10), Alicia Kunz, Audra Mollet (ME91), Jade Herman (IS 09), Ashley Johnson (IE 09), Monique (Hoffman) Kramer, Diana (Elrod) Penginer (ChE 86); front row from left: Angie (Schofield) Stucker (ChE 89), Melanie Jeppesen (IS 09), Elaine Petry (Chem 14), Gabby Iverson (IS 13), and Joyce Kovacs (GeolE 90).





6: A few alumni on M Hill. Chris Peters (MinE 12), Greg Hintgen (EE 99), Matt Goeden (CEng 03), and Tyler Artz (MinE 15).

7-1, 2: Tailgating before the Colorado Mines football game.



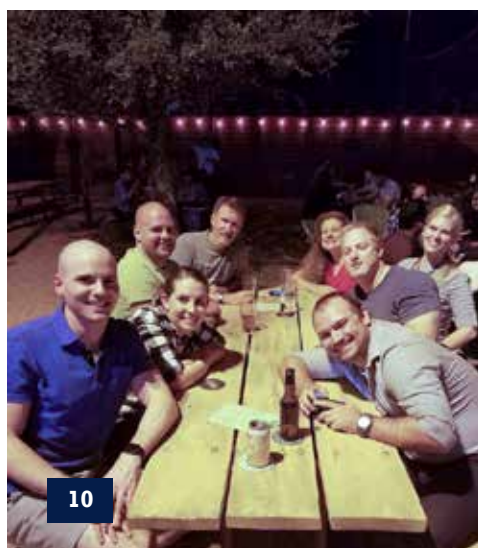
8: Leading a career development session on campus are, from left to right, Katie Steever (IS 03), About You Physical Therapy; Jamie Toennies (Geol 01), United Way of the Black Hills; Jane Roseland (Chem 83), Stevens High School; State Senator Craig Tieszen (ChE 71), retired police chief; Amy Koenig (ChE 95), Black Hills Corporation lawyer; and Joy Mueller (MetE 07), USD Sanford School of Medicine.



9: Kerrville, Texas—The Texas Hill Country SD Mines pre-muster gathering was held September 30, 2016, in Kerrville at Rails-Cafe at the Depot. From Spring Branch, Bulverde, Kerrville, and Fredericksburg were (left to right): Daryl (ME 67) and Karen Heusinkveld, Linda and Wayne (CE 73) Grace, Jim (ChE 58) and Sherry Adams, Chuck (CE 61) and Diana Fishel, and Sam (ME 64) and June Begeman. Everyone enjoyed reminiscing about their career activities and travels of the world.



10: Houston, Texas—The Houston alumni muster was held September 30, 2016, at the Kirby Ice House. From left to right: Ryan Ziegler (ChE 11), Grace Moehring (ChE 14), Jake Moehring (ChE 10), Dan Carlson (ChE 77), Sue Douglas (ChE 77), Rose Luvaas (ChE 08), Ben Salverson (ChE 06), and Jason Luze (IS 15). It was a beautiful evening for sharing laughs with fellow Hardrockers.



11: Ken Miller (CE 75), Larry Simonson (EE 69), Marty Jackley (EE 92) and Greg Hintgen (EE 99) catch up after a Marty-Jackley-for-Governor fundraiser on December 6, 2016.



12: Rapid City—The Rapid City muster at the SD Mines versus Adams State football game on October 1, 2016. Pictured left to right: Dale Obenauer (EE 75), Paul Gnirk (MinE 59), Barb and Steve Doshier, Deb Wagner, Bonnie Berg, Cliff (CE 79) and Deb (EE 78) Bienert, Rick Clegg (CE 73), Sharon and Tom Zeller (ME 70), Pat Hallauer (ME 76), Dave Berg (ME 73), Jim Green (ME 74), and Pete Birrenkott (ME 71).



13: Korey (EE 05) and Carroll Kirschenmann and Marge and Don (EE 51) Range after the Presentation College Basketball game.

14: Michelle Kelley (EnvE 13), Lee Swindler (EE 88), and Marty Amble (CE 68) hanging out before the Metro State University in Denver, Colorado.





15



16

15: Karen Swindler (ChE 88) is pictured with Owen and Drew Kelley (MetE 11).

16: Coach Jason Henry and Doyle Heisler (EE 91) reminisce about their North Dakota roots before the UCCS basketball game.

17: Steve Perez (CE 09), Coach Zach Tinker, and Kyle Garstang (IE 02) pose after the Hardrockers football game against CSU-Pueblo in Pueblo, Colorado.

18: Mikel Frost, Steve Perez (CE 09), and Connor Silveria hang out after the CSU-Pueblo football game.



17



18

19-1, 2, 3, 4: Mine Expo
September 2016.

20: Tom Montoya (EE 88),
Dustin Kittleson (EE 08),
Doug (GeolE 78) and Sandy
Thies, Natalie Montoya, and
Tom Sargent (ME 70) enjoy a
pre-game get-together in Grand
Junction, Colorado, before the
football game against Colorado
Mesa.





The Campus Hub

by the numbers

1962

is the year the Surbeck Center was built.

989
2859

is today's enrollment.

was the School of Mines enrollment when the Surbeck Center was built fifty-five years ago.

65,754

is the existing square footage of the Surbeck Center.

10,000

will be the number of square feet of the new March Alumni Center planned for the corner of Birch and East Kansas City streets.

83,754

will be the number of square feet of an expanded Surbeck Center, after a Student Success Center and additional studying, dining, and meeting spaces have been constructed.

300

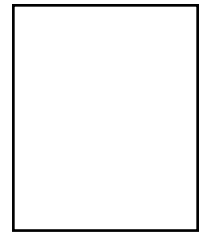
new dining hall seats will be added to the Hardrocker Café & Dining areas.

SOUTH DAKOTA



SCHOOL OF MINES
& TECHNOLOGY

501 E. Saint Joseph St.
Rapid City, SD 57701



Soaring to New Heights

On July 9, 2016, Steve Rathbun (MinE 80) realized a dream when he broke a Utah state distance flying record, soaring 494.3 miles in a plane with no engine. After two prior attempts, Rathbun flew his 1978 Rolladen-Schneider LS3 glider from Salt Lake City, Utah, to Hot Springs, South Dakota. He follows in the footsteps of his father, Mines alumnus and former professor Grove Rathbun (MinE 52), who served as a fighter pilot for the Air National Guard and who had been president of the South Dakota Pilots Association.

