

A Supercomputer with a Mission

Commencement 2008

M Going Green



Summer 2008 Volume 98 Number 2

# Mines

Colorado School of Mines Magazine



Tapping New  
Water Resources in  
the Arid West



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# Contents

Summer 2008



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## Features

### 22 Commencement 2008

Pulitzer Prize winning energy expert speaks as oil reaches yet another record high. Also, Nobel Prize winning physicist speaks at Graduation Banquet.

### 26 Water Works

A new research center at Mines is helping to develop technological solutions to the growing scarcity of water in the arid West. By developing enhanced water purification technologies, previously untapped water resources could become useable.

### 30 RA Power

The new 23-teraflop supercomputer recently installed on campus comes with a mission: to compute energy solutions. By facilitating a wide range of traditional and non-traditional energy research, the new computer, nicknamed "Ra," is likely to accelerate progress in this pressing arena.

Cover photo: Shutterstock

## Departments

4 Inbox

5 Letter to Our Readers

6 Inside Mines

10 New Frontiers

12 Just Published

14 Scoreboard

16 Investing in Mines

18 Spotlight

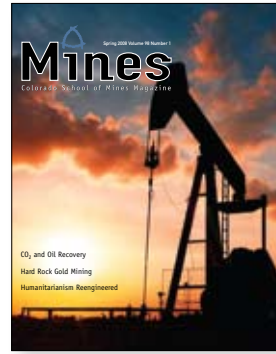
34 The Network

38 Fast Forward

Class Notes, Weddings,  
Class of 2029, Passings

52 Last Word

53 At Your Service



## Humanitarianism Reengineered

Reading "Humanitarianism Reengineered" in the spring issue of your magazine made me truly proud of the Colorado School of Mines. Most engineers are kind helpful people that love to help others. It is great that Mines is providing new engineers with the insight as to how they can be of service.

Your description of the project in Honduras was of special interest to me. Because I participated in a project that provided a couple of hundred rainwater cisterns to poor people in Central America this year, it is easy to understand how significant the student's work in a remote Honduran community really was. Potable water and simple sanitation facilities have unimagined payoffs. When children aren't sick as often, they attend school more. When they are well, they are more alert and learn more. Parents feel better too and become more productive. Community members that work to make their own lives better develop a "can do" spirit that spills over into other aspects

of their lives. And projects that are easily maintained and can be sustained for a long time allow communities to work on other improvements.

It would certainly be commendable if more engineering schools and maybe more of our engineering societies would encourage engineers to volunteer for projects like this. We all have training in skills that are useful.

It was also terrific to read that Dave Chasis arranged for the pipe for the Honduras project. Dave was a real nice guy as a student. And you know what, he still is.

**Richard D. Wyatt '61**

In your Last Word [from the winter issue, p. 52, vol 98, no. 4] you had an article about Sao and Inge Seng '53. Very interesting, as Sao and I were close friends our last couple of years at Mines, as well as classmates.

I attended their wedding in Denver in 1953. He was a great guy!

Many years later, I was driving through Austria when I realized I was close to their Austrian address, so I dropped in unannounced to visit them. Inge and the two little girls were there. Inge had left Burma years before, and at my visit, had not heard from Sao for some eight years.

It eventually came out that Sao, this fine, brilliant guy, my good friend, had been murdered about one week after Gen. Ne Win Seized power in March 1962\*. So poor Inge had been a widow for about eight years, but didn't even know it.

What a shame their marriage was marred by tragedy, totally unanticipated and undeserved.

**Haldon J. Smith '53**

\*Ref: Southeast Asia, by Tillman Durdin, New York Times Company, Library of Congress C.C.N: 65-27529, p. 58

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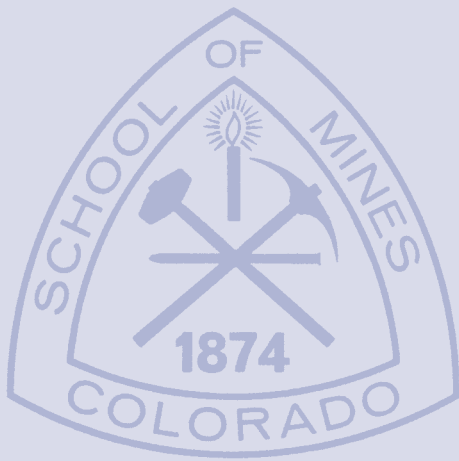
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## Dear Readers,



If you are about to head off on a summer trip, then slip this in with your reading material—there's plenty to keep you interested.

The Blue Key initiative to make the M green by installing LED light bulbs heads up Inside Mines. Turn the page and you can see some pictures an EPICS team took from 90,000 feet above the Colorado plains. And with gas over \$3.50 a gallon, you may enjoy the story about a 680 miles-per-gallon vehicle a Senior Design team recently entered into a national competition.

Research covered in New Frontiers includes the new Center for Revolutionary Solar Photoconversion and the Advanced Mineralogy Research Center. The former raises Mines' profile in a highly active research field; the latter has brought some remarkable technology to campus capable of providing instant mineralogical analysis of raw samples.

In "Commencement 2008," by Trisha Bentz Kendall, you can read about Daniel Yergin's visit to campus, which could not have been more timely; the author of the Pulitzer-winning book, *The Prize: The Epic Quest for Oil Money and Power*, spoke on a day when the price of oil reached yet another record high. Not surprisingly, those gathered listened attentively. His comments are highlighted in the article, and you can listen to his entire speech by going to the magazine website: [www.mines.edu/magazine](http://www.mines.edu/magazine).

The other two features are resource-focused. "Water Works," by Nicole Branan, discusses the School's latest response to the growing pressure on water resources in the West. In "RA Power," I write about Mines' new supercomputer (nicknamed "Ra") and its mission of advancing energy research. The article touches on some interesting energy-related science, while also providing a window into the burgeoning field of computer simulations, modeling and virtual experimentation.

In Network, read about Reunion 2008 and this year's Alumni Association award winners. Don't miss the profile of James "Pete" Mullinax, who was forced to bail out of his B-17 Flying Fortress over Germany during World War II. And I hope you'll find Casey Morse's reflections in Last Word inspiring: A member of the Class of 2008, he shares some candid thoughts at this pivotal time in his life.

Thank you for continuing to read *Mines* magazine. The fall issue is already taking shape, but if you have ideas for stories, please don't hesitate to share them. The same goes for any thoughts you have on this issue. Send email to [magazine@mines.edu](mailto:magazine@mines.edu), or send a letter to the address listed on this page.

Best wishes,

Nick Sutcliffe

Editor and Director of Communications, CSMMAA

# Campus News

## M Goes Green for 100th Anniversary



Peters Photography

Steven Meyerhoff (left) and Brad Bettag are leading the Blue Key initiative to convert the M to LED light bulbs.

The legendary white M that sits above the Colorado School of Mines campus on Mt. Zion turned 100 this year—and to commemorate the event, the famous landmark is going “green.”

Members of Mines’ chapter of Blue Key International Honor Society plan to replace the monument’s 1,653 incandescent light bulbs with energy-efficient light-emitting diodes (LEDs). And, with the initial LED bulb upgrade likely to cost more than \$30,000, the proposed change is no small undertaking.

Finances aside, Steven Meyerhoff, Mines Blue Key member and M chair, said the idea behind the switch was based on the need for an upgrade.

“I felt it was time for students to step up and take initiative on leading issues at our school and in our country. It is important to set a tone that we are working toward sustainable energy means,” Meyerhoff said.

The energy and dollar savings after the switch will be substantial. Meyerhoff said the average 12-hour burn time of the monument’s 11-watt bulbs uses about 73 kilowatt-hours per night; with LEDs, the nightly usage will drop to about 11 kilowatt-hours. In addition, Blue Key currently has to buy replacement bulbs every year, but the new LEDs will last about four years.

“Right now we spend close to \$2,200 on energy costs to light the M for one year. With the new bulbs this cost will be cut to around \$375. Also the M will look crisper, emanating a bright white light, instead of the traditional pale yellow that incandescent bulbs produce,” said Blue Key member Brad Bettag.

“Steve and I felt that it was a good time to give back to the M and do something great for the school and for all of Golden. With the Energy Independence and Security Act (EISA) of 2007, incandescent bulbs are being phased out in favor of LED and fluorescent bulbs. Instead of delaying the inevitable, we decided to push forward and convert the M to new LED bulbs in commemoration of the M’s centennial,” said Bettag.

The M was constructed in 1908 when 250 Mines students and 20 faculty members loaded a supply train of burros and packed their way up Mt. Zion. In 1931, Blue Key members borrowed a tractor, generator, poles, wire and bulbs to light the M for homecoming. The first lighting of the M was such a huge hit, students and civic committees raised money to light it permanently in 1932.

By 1948, the lighting became fully automatic. Forty-one years later in 1989, the lighting system was modernized including wiring and conduit up-



Shutterstock

Jennifer Nekuda



grades. The original light sockets were replaced with multi-bulb weatherproof fixtures. Lighting was computerized in 2003 with a wireless antenna system developed by a Mines Senior Design team.

The students said the support behind the recent initiative has been overwhelming. The Associated Students of Colorado School of Mines has pledged more than \$18,000 in support of the effort, and another \$12,000 is slated through use of the funds generated by the school's student tech fee.

The group also raised about \$500 through the sale of T-shirts and has rallied \$500 in financial support from alumni. Donations to aid Blue Key's fundraising efforts and future lighting can still be made through the Colorado School of Mines Foundation.

"They really took an idea and ran with it," said Blue Key advisor Michelle Kozel. "The students were very creative in their efforts to do this."

Bettag said commemorating the 100th anniversary of the M during E-Days made for a good opportunity to announce the LED conversion plans.

## Women's Soccer Team Spends 2008 Spring Break Mentoring Students in Jamaica

For most college students, spring break in Jamaica means sun, surf, dancing to reggae music and umbrella drinks. However, for the Colorado School of Mines women's soccer team, it was so much more.

Accompanied by their head coach Frank Kohlenstein, the Orediggers went to Kingston, the capital city of Jamaica, to teach and mentor local young women in the areas of math, science and athletics during their 2008 spring break. The Mines players returned from their trip with a new understanding of the world and the part they could play in making it a better place. "I have found I love trying to interest girls in engineering as well as soccer," exclaimed team captain Diane Wetzel. "This is something that I hope our team can continue to do at home."



## Mayor Hickenlooper Speaks on Sustainability

How can we make our communities more sustainable? Denver Mayor John Hickenlooper offered some answers to this question at the 2008 Young Environmental Symposium held April 7. More than 350 students, faculty and community members gathered on campus to hear about the city of Denver's sustainability initiative, Greenprint Denver, and plans for making the upcoming Democratic National Convention the "greenest" convention in history.

The mayor took questions from the audi-

ence on all things green, engaging the Mines community in a lively dialogue and urging students and faculty to incorporate environmental considerations into their work and lives. "You're already international, already connected through your student body and your professors that come from all over Earth. You get to make those decisions about how you're going to impact the world," he said.

The Young Environmental Symposium is an ongoing lecture series at Mines that was established by alumnus Herb Young '39 and his wife, Dodie, to promote the exploration of important questions about our environment and Mines' mission in relation to sustainability. (Hickenlooper's remarks are available as one of the Web Extras on the *Mines* magazine website—[www.mines.edu/magazine](http://www.mines.edu/magazine).)



## Symposium Explores New Observatory to Study High Energy Cosmic Rays

In May, Mines hosted the International Astroparticle Physics Symposium, where 130 of the world's leading astrophysicists gathered from 19 countries. James Cronin, a Nobel laureate in physics, was among the speakers who offered more than 70 presentations on ways to learn more about ultra-high energy cosmic rays—thought to be among the most energetic particles in the universe.

Fred Sarazin, an assistant professor of physics who helped organize the symposium, said those gathered examined future projects and observatories that will detect astroparticles spanning an energy spectrum of 10 orders of magnitude.

Sarazin, along with his colleague from the Physics Department, Lawrence Wiencke, study high-energy cosmic rays as part of the International Pierre Auger Collaboration, which operates a detector in Argentina the size of Rhode Island. The collaboration is preparing a proposal for another much larger observatory—the size of Massachusetts—that would detect high-energy particles at a site in the northern hemisphere.

This \$100-plus million project, dubbed “Auger North,” was presented as part of the future projects at the symposium, with more than half of the funds expected to come from outside the United States.

“Where Mines and Colorado have an important stake is that this observatory, if funded, will be located in southeastern Colorado, around the town of Lamar,” Sarazin says.

“Fred and I continue to receive very positive comments from the participants, both about the symposium and about the School of Mines,” Wiencke says. “In the astroparticle physics community, CSM is now on the map.”



## EPICS Team Reaches Stratosphere

At the beginning of the past academic year, a team of EPICS 251 engineering students successfully

launched a balloon to an altitude of nearly 18 miles above the plains of Eastern Colorado. Suspended below team Sat V's balloon was a device they designed that took panoramic photographs of the Earth's horizon and the landing site below. Along with five other teams from Colorado universities, Sat V was participating in the DEMOSAT program sponsored by NASA and the Colorado Space Grant Consortium.

DEMOSAT challenges student teams to design “satellites” that perform various functions while flying on a high-altitude balloon or after landing on the ground via parachute. The five-member Mines team conceptualized their design in the spring of 2007 for their EPICS 251 class project. Team members included Adam Kelson, Nathan Weinsteen, Will Hatrick, Brandon Vasboe and Zuair Al Awanmi. The team was advised by Joel Duncan, senior lecturer with the EPICS program, and Robert Knecht '70, MS '75, PhD '79, director.

SAT V's design consisted of a hard protective shell that housed four high-resolution Canon digital cameras mounted at 90 degree angles. This configuration, along with the addition of special wide-angle lenses attached to the front of each camera, enabled the satellite to take 360 degree panoramic photographs. All non-critical parts of the cameras were stripped away to minimize weight. The quantity of photographs taken at specified times and altitudes were programmed by a brainstem and pressure transducer wired to the cameras.

Over 600 photographs were taken of the landscapes below during the two-hour flight. At the highest altitude, the curvature of the Earth and the boundary between the atmosphere and the blackness of outer space are clearly visible. After the flight, the teams were rewarded with a trip to the Kennedy Space Center in Florida to present their results and watch the launch of the space shuttle Endeavor.





## Mines Places 9th at Shell Eco-Marathon

Mines Senior Design Team “Ramblin Wreck” placed ninth at the 2008 Shell Eco-Marathon Americas Challenge held in April in California. The competition pitted 38 university and high school teams against each other to see whose vehicle would manage the most miles per gallon.

Competitors were charged with building a vehicle capable of completing eight laps (about 11 miles) around the inside course of the California Speedway in Fontana, CA. The teams were judged on fuel consumption using a mathematical conversion that allowed fuel cell and combustion engines to be compared against each other. This year’s entries included 28 vehicles powered by combustion engines, six by fuel cell/hydrogen technology, one by diesel fuel, one by liquid petroleum gas and two by solar power.

“While most of the classes at Mines teach engineering principles in a classroom setting, competitions like these enforce teamwork and managerial skills as students take what they have learned in the classroom and apply it to real world scenarios,” said A.J. Tupper, team leader.

The Mines team—composed of Tupper, driver Dana Drake, Jack Bell, Angie Blum, Gavin Custodio, Bill Everson, Nick Macon and

Tanner Stamey—competed at the event for the first time this year.

“Everyone had the same set of rules and all the cars came out different—demonstrating there is more than one solution to a problem,” said Richard Passamaneck, the team’s faculty advisor.

Tupper, who is going to work for Shell in Martinez, CA, said the Mines team focused on building a reliable combustion vehicle—named “Peanut Butter”—using as many off-the-shelf components as possible. They built a frame around a four-stroke, fuel-injected 49 cc motor from a Yamaha scooter and custom-built wheels using mountain bike hubs and 650 C road bike wheels and tires.

“During each run, the engine was only run while the vehicle was accelerating to reduce idling losses. This design achieved 679.4 miles per gallon placing us ninth in the competition. This was the best finish for a first generation vehicle as many of

these teams have competed in not only last year’s Eco-Marathon event, but in the SAE Supermileage competition,” said Tupper. The Shell Eco-Marathon has been held since 1939 but came to the U.S. for the first time only last year.

This year’s winning team, Mater Dei High School, achieved 2,843.4 miles per gallon and received \$10,000 for their school.



Dustin Haymie

## In Brief...

**Nathan George**, a senior majoring in chemical engineering, received a Goldwater Scholarship. Scholars were selected on the basis of academic merit from a field of 1,035 mathematics, science and engineering students who were nominated by the faculties of colleges and universities nationwide. The one- and two-year scholarships cover tuition, fees, books and room and board up to \$7,500 per year. The scholarship program honoring Barry M. Goldwater was designed to foster and encourage outstanding students to pursue careers in the fields of mathematics, the natural sciences and engineering. It is the premier undergraduate award of its type in these fields.

**Mines** was recognized as the third top university contributing to the operations research journal, *Interfaces*. *Interfaces* is a bimonthly journal of INFORMS and is dedicated to improving the practical application of operations research and the management sciences to decisions and policies in today’s organizations and industries.

**Collin Donohue** was awarded the Rickover Fellowship through the Medical University of South Carolina, Knolls Atomic Power Laboratory, Bettis Atomic Power Laboratory and the Department of Energy. The program is designed to meet the needs of the Naval Reactors Division of the U.S. DOE for the development of science and engineering technology as it pertains to naval nuclear propulsion. The fellowship provides funding for the completion of a PhD in nuclear engineering or a directly related field and includes an appointment at either KAPL or Bettis after graduation.

**Karem Tello**, a graduate student in the materials science program, has been awarded the 2008-2009 AWS International Scholarship. This award recognizes an outstanding international student pursuing education in the field of welding. Tello is performing her research at the Center for Welding, Joining and Coatings Research under the guidance of Patricio F. Mendez, assistant professor of metallurgical and materials engineering.

Two Mines students received the nationally competitive Critical Language Scholarship sponsored by the U.S. State Department. **Paul Johnson** was awarded a fully-funded critical language scholarship to study Korean in Korea this summer. **Jackson Lee** was awarded a fully funded advanced Chinese language Scholarship to study Chinese at Suzhou University. Johnson and Lee are the first two Mines students ever to receive the award.

The second annual **Climate Action Days** was held on campus April 16-25. This year’s event—which was organized entirely by students—included festivities, lectures and movies and was hosted by the CSM Sustainability Committee, the Student Council on Sustainability, Engineers for a Better World and Earthworks. The event ended with the Earth Day Celebration on Kafadar commons featuring climate-oriented retailers and scientists, free food, drinks and live music.

## Solar Conversion Research Center

The School has been officially named part of the Center for Revolutionary Solar Photoconversion (CRSP), the newest research center of the Colorado Renewable Energy Collaboratory. CRSP is broadly focused on ways to convert the sun's energy to low-cost electricity and fuels.

"Mines involvement in CRSP will greatly enhance our research presence, particularly in the areas of photovoltaic materials and materials for fuel cells," says Craig Taylor, a professor of physics and a CRSP co-director.

Colorado Gov. Bill Ritter, U.S. Sen. Ken Salazar and officials from the collaboratory announced this spring that

Institute, calls the School's involvement in CRSP "an exciting challenge" that will allow Mines to attract "even better students and new faculty because of the science and its great relevance to create a cleaner, cheaper and more equitable global energy system."

Nummedal adds, "It's an opportunity for the School to play a leading role at the frontier of such basic physics issues as how to convert photons from the sun to electrons for electricity far more efficiently than what is currently achieved in conventional solar photovoltaic cells."

He also said CRSP implies that the Colorado university community is taking the recommendations of the National Academy of Engineers seriously: "That the most important technology development for planet Earth over the next generation is to make solar energy commercial."

"Solar energy is, by far, our largest clean energy resource," Nummedal says.

Taylor said that he's certain there will be a greater reliance worldwide on solar energy in the future, but by how much he's not sure: "Whether or not solar energy will provide a large fraction of our demands for electricity and fuel in the next 25-50 years remains an open question."

CRSP is wasting little time starting its work; researchers will begin testing some ideas this fall. Improving the efficiency of photovoltaic (PV) panels is high on the agenda. Currently operating at between 8 and 20 percent efficiencies, Taylor says, "There's considerable room for improvement, and in fact, there must be considerable improvement in both performance and cost before PV is a major contributor." The same goes for other conversion technologies: "Solar thermal devices are not currently competitive with coal-fired power plants. Practical methods for using solar energy to split water to form hydrogen as a fuel are even further away from practicality," said Taylor.

The collaboratory expects to announce additional centers in wind energy, carbon management and energy efficiency later this year, and Nummedal says the collaboratory is currently working on prioritizing its research goals.

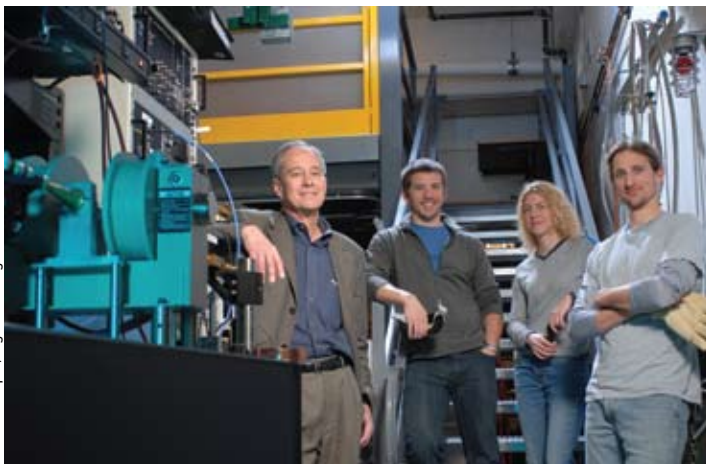
"We expect all three centers to be approved by the board and announced before this year is out," Nummedal says. "A number of excellent researchers are already in place and more than a dozen companies have offered financial support."

CRSP will be dedicated to basic and applied research at the collaboratory's four member institutions: the Colorado School of Mines, Colorado State University, the University of Colorado at Boulder and the National Renewable Energy Laboratory (NREL). In addition, 12 companies will pay as much as \$50,000 a year to be CRSP members.

Specifically, Mines and the other groups will perform research and engineering in photovoltaics (inorganic and organic), photo physics, photoelectrochemistry, photochemistry, photo biology and nanoscience.

Taylor says the original idea for the center was a response to a solicitation by the Basic Energy Sciences division of the U.S. Department of Energy. "The proposal was mainly electrochemistry and photo-electrochemistry," Taylor says. "This proposal was not funded, but the four member institutions decided to form an expanded institute that included materials research on photovoltaics and fuel cells."

Dag Nummedal, director of the Colorado Energy Research



Thomas Cooper, lightboximages.com

## Mineralogy at Mines Fundamentally Changed by New Technology

Thanks to the opening of Mines' new Advanced Mineralogy Research Center, mineralogy at Mines has been changed in some fundamental ways. The new center features sophisticated technology developed by the Australian firm, Intellection Pty Ltd that enables large-scale quantitative analysis of mineral samples with an unparalleled degree of detail and complexity. To date, Mines is the only university in North America equipped with QEMSCAN, as it is called, and Intellection is excited about it being used in such a robust research setting: "The AMRC has the resources and expertise to produce groundbreaking research while setting new standards for mineralogical training," said the company's CEO, Calvin Treacy, at a launch event on April 3.

Traditionally, geologists and mineralogists analyze minerals by using a microscope, electron microprobe or scanning electron microscope on small sample areas and making largely qualitative extrapolations to larger sample populations. With the imaging and software capabilities of QEMSCAN, scientists can derive quantitative information about the distribution, composition, and angularity of minerals, and the fabric, distribution, texture and porosity of materials. It can also examine how those qualities are related in a particular specimen and in larger sample groups.

QEMSCAN is based on a scanning electron microscopy platform, utilizing an electron beam source, four energy-dispersive detectors, and enhanced software capabilities for compositional and image analysis of materials. Electron beam dispersion patterns are determined by mineral composition; with specialized software that interprets these patterns, a highly detailed analysis of the chemical composition and mineralogy of a given material can be deduced. Also, so long as samples present a relatively flat surface to the beam, they do not need to be specially prepared, allowing for rapid analysis of rocks, soils and materials.

Since opening, the center has used the new technology to study diverse samples for a range of interdisciplinary purposes. In geometallurgical research, ore materials from several copper, gold and diamond deposits are being examined to resolve processing issues and to enhance mining operations. In energy applications, the laboratory is being used to enhance understanding of oil shale in exploration and operations, providing a comprehensive picture of miner-



alogy and fracture distribution in rocks. Planetary scientists are calling on the center's capabilities to help develop lunar simulants—materials that replicate the surface of the moon—in order to assist in engineering a possible lunar post.

In addition, basic fundamental research into the composition and distribution of minerals in materials is ongoing in the new center. Researchers have been studying and refining the diverse compositions of feldspar in granites from Scotland, minerals in metamorphic rocks from Antarctica, and a variety of diamond-related materials from South African kimberlites.

And the center has some less conventional projects in the pipeline. One will examine the iron content of soils in areas with high rates of tuberculosis infection in South Africa. Another involves analyzing the mineral precipitate scale that slows the flow of hydrothermal fluids through Iceland's network of geothermal pipelines. The center will also take on larger characterization studies for some operating mines in the Americas.

Karin Hoal, director of the new center and a research professor of geology and geological engineering, believes the center's new technology and its diverse intellectual resources have immense potential. "We're really just beginning to see the potential the Advanced Mineralogy Research Center holds," she said. "As companies, partner universities and researchers continue to introduce new projects and pose new questions, we are sure to uncover more innovative applications for our center's expertise with this pioneering technology."



### Combustion Synthesis

Cosan Unuvar, a research faculty member of metallurgical and materials engineering, recently published a book on combustion synthesis (CS) entitled *Combustion Synthesis for NASA's New Vision for Space Exploration: Moon, Mars, and Beyond*. A popular research topic during the last three decades, CS involves quite complex mechanisms that occur simultaneously at rapidly changing high temperatures. Gravity plays an important role in the properties of the reaction and final product, as does electric current. Unuvar's research utilized a chemical oven technique, where the sample was embedded in an exothermic powder mixture. Phenomena investigated included reactive settling, dissolution and precipitation, and reactive liquid metal flow. CS is considered as a potential technique with various advantages and applications in NASA's new vision for space exploration. (VDM Verlag Dr. Muller, Saarbrücken 2007)

### Mining and Corruption

Over the past several decades, various studies have found that mineral wealth and its exploitation may retard the economic growth of producing countries. One possible explanation for such troubling findings is that mineral production breeds corruption. In a recent *Resources Policy* article entitled "Mining and Corruption" written with two former students at the Catholic University of Chile,

John Tilton, professor emeritus of economics and business, explores the relationship between mineral export dependency and corruption for some 70 countries over the 1998-2002 period. With energy exporting countries, they find corruption tends to rise unambiguously with dependency on fuel exports. In contrast, non-fuel mineral exports may increase or decrease corruption. In particular, countries that export diamonds, gold and other high value non-fuel minerals are more likely to suffer from corruption than other non-fuel mineral exporters. In addition, poor countries exporting non-fuel minerals are likely to struggle more with corruption than those with medium and high per capita incomes. (Published in Volume 32, Issue 3, September 1, 2007)



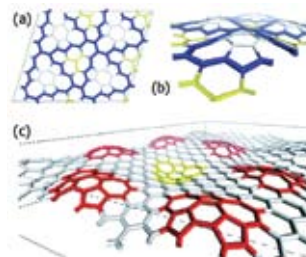
### Steels: Processing, Structure, and Performance

George Krauss, a professor emeritus of metallurgical and materials engineering, recently published *Steels: Processing, Structure, and Performance*. The book is a comprehensive guide to the broad, dynamic physical metallurgy of steels. The volume is an extensively revised and updated edition of the classic 1990 book, *Steels: Heat Treatment and Processing Principles*, and includes 11 new chapters. The interrelationships among chemistry, processing, structure

and performance—the elements of physical metallurgy—are integrated for all the types of steel discussed. The evolution, characterization and performance of steel microstructures are described, with increased emphasis on deformation and fracture. And the coverage of thermal processing and its effects on steels is also expanded. (www.asminternational.org)

### Nano-Engineering Graphene

Two Physics Department faculty members, Mark Lusk and Lincoln Carr, have published a paper in *Physical Review Letters* on a new direction for research in graphene electronics. Entitled "Nano-engineering Defect Structures on Graphene," the authors predict that it is possible to build electronic components on the atomic-scale by carefully adding defects to an otherwise perfect graphene sheet. Graphene is a single atomic layer of carbon atoms with properties that make many people believe it will replace silicon as the primary material for next-generation electronics. The authors have discovered that it is possible to make small blisters and ridges



on these graphene sheets, which might be used to store electric charge and direct current. Their theoretical predictions are expected to challenge experimental groups to synthesize such structures. (Vol. 100, 175503, 2008)

### Humanitarian Education

Barbara Moskal, Catherine Skokan, David Muñoz and Joan Gosink recently published "Humanitarian Engineering: Global Impacts and Sustainability of a Curricular Effort" in the *International Journal for Engineering Education*. The article highlights the successes of Mines Humanitarian Engineering program and the sustainability of the program beyond the initial period of funding. (Vol. 24, No. 1, 2008)



### Assessment and Engineering Education

*Designing Better Engineering Education Through Assessment* edited by Spurlin, J., Rajala, S., & Lavelle, J. includes two articles by Mines faculty members. Barbara Moskal's paper, "Using Assessment Results for Improving Student Learning," discusses how research developments in engineering education can be directly applied to the classroom and improve educational outcomes. Barbara Olds and Ron Miller's paper, "Using Formative Assessment for Program Improvement," explores how formative assessment can be used to improve engineering programs by providing feedback in time for mid-stream corrections to courses and curricula in response to student outcomes. (Stylus Publishing, 2008)

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# Scoreboard

Athletics

## CSM Cycling Team 4th at NCCA Division II Nationals

Just two weeks after winning the Rocky Mountain Athletic Conference title, the CSM Cycling Team took fourth place at the 2008 NCCA Road National Championship. Nearly 40 Division II schools competed in the series of events to determine which

would rank among the top collegiate cyclists. Mines was represented by Zak Grabowski, Melissa Marts, Topher Hurley, Brady Kappius, Aaron Heun, Shaun Higgins, JT Teerlink, Sarah Roberts and Alex Dobrinen.

Tallying the results from the road race, criterium and team time trial, the team came in fourth overall, just behind MIT, Western Washington and Dartmouth. Consistent results by all team members helped to boost the team's standing.

Looking forward to the fall semester, the team hopes to defend its 2007 National Mountain Bike Championship Title in North Carolina near the end of October 2008. The CSM Cycling Team is a coed club sport comprised of over 50 mountain bike, road, track and cyclocross athletes. For more information, visit [www.CSMcycling.com](http://www.CSMcycling.com).



Brandon Turnan

Mines' Zak Grabowski leads the RMAC criterium event. Brady Kappius also is in view. The CSM Cycling Team came away with the conference title for 2008.

## CSM Athletics Home Schedules Fall 2008

### VOLLEYBALL

Aug. 29	Univ. of Wisconsin – Parkside	3:30 pm
Aug. 29	Winona State Univ.	7:30 pm
Aug. 30	Slippery Rock Univ.	3:30 pm
Aug. 30	Wayne State College	7:30 pm
Sept. 8	Univ. of Hawaii – Hilo	7:00 pm
Sept. 26	UC – Colorado Springs	7:00 pm
Sept. 27	Colo. Christian Univ.	7:00 pm
Oct. 10	Western N.M. Univ.	7:00 pm
Oct. 11	N.M. Highlands Univ.	7:00 pm
Oct. 17	Fort Lewis	7:00 pm
Oct. 18	Mesa State	7:00 pm
Oct. 28	Chadron State	7:00 pm
Oct. 29	Fort Hays State Univ.	7:00 pm
Oct. 31	Nebraska – Kearney	7:00 pm
Nov. 7	Regis University	7:00 pm
Nov. 8	Metro State	7:00 pm

### FOOTBALL

Sept. 6	Fort Hays State Univ.	12:00 pm
Sept. 13	Western N.M. Univ.	12:00 pm
Sept. 27	CSU – Pueblo	12:00 pm
Oct. 4	Mesa State (Homecoming)	12:00 pm
Oct. 18	Adams State	12:00 pm
Nov. 1	Nebraska – Kearney	12:00 pm

### MEN'S SOCCER

Aug. 28	Upper Iowa	4:30 pm
Sept. 12	Regis University	7:00 pm
Sept. 14	Metro State	2:30 pm
Sept. 21	Colo. Christian Univ.	2:30 pm
Sept. 26	St. Edward's Univ.	7:00 pm
Sept. 28	Incarnate Word	12:30 pm
Oct. 3	UC – Colorado Springs	7:00 pm
Oct. 5	CSU – Pueblo	2:30 pm
Oct. 24	Mesa State	7:00 pm
Oct. 26	Fort Lewis	2:30 pm

### WOMEN'S SOCCER

Aug. 28	Upper Iowa	7:00 pm
Aug. 31	Augustana College (SD)	12:00 pm
Sept. 7	Minnesota State – Mankato	12:00 pm
Sept. 14	Metro State	12:00 pm
Sept. 21	Colo. Christian Univ.	12:00 pm
Sept. 26	Midwestern State Univ.	2:00 pm
Sept. 28	West Texas A&M Univ.	3:00 pm
Oct. 3	UC – Colorado Springs	4:30 pm
Oct. 5	CSU – Pueblo	12:00 pm
Oct. 24	N.M. Highlands Univ.	4:30 pm
Oct. 26	Fort Lewis	12:00 pm

## Men's Track & Field Places 8th at Outdoor National Championships



Nick Maynard

Colorado School of Mines sent nine student-athletes to compete in the 2008 NCAA Division II Outdoor Track & Field National Championships held on May 22-24 in Walnut, CA. The Oredigger men tied for eighth place, marking their best finish at outdoor nationals in program history. In addition, five individuals earned All-American honors.

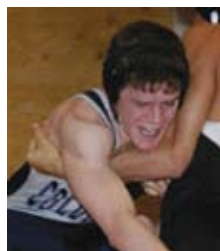
Joel Hamilton (10,000m; 5,000m run), Mark Husted (800m run), Ryan Miles (3,000m steeplechase), Nick Maynard (800m run) and Ian Storz (long jump) each garnered All-American recognition for the men's team, whose previous best finish at outdoor nationals was 13th in 2001. Sean Cusick (3,000m steeplechase) also competed for the men, while Melanie Peddle (3,000m run), Savannah Afoa (discus) and Jennifer Picucci (triple jump, long jump) represented the Oredigger women's team.

## Oredigger Wrestling Squad Earns Recognition on NWCA's All-Academic Top 15

The wrestling program has earned recognition on the National Wrestling Coaches Association's NCAA Division II All-Academic Top 15 Teams list for the 2007-08 academic year.

The Orediggers, who came in at number 15 on the 2007-08 list (3.127 cumulative team GPA), also landed four individuals on this year's NCAA Division II All-Academic Wrestling Teams, including Cody Weitzel, who earned First Team All-Academic honors. Weitzel was one of only two wrestlers on the NWCA's All-Academic Team (133 student-athletes) with a 4.00 cumulative GPA. Also a First Team Academic All-Rocky Mountain Athletic Conference (RMAC) performer in 2007-08, Weitzel is majoring in mechanical engineering at Mines. Earning NWCA Honorable Mention All-Academic recognition for Mines were Kellen Costelow, Chris Saykally and Bobby Strain.

In the 15-year history of the NWCA's All-Academic Team awards, no other school has won more Academic National Championships than Colorado School of Mines, which has earned the honor on five occasions (1994-95, 1995-96, 1997-98, 1998-99 and 2005-06).



Cody Weitzel

## Oredigger News & Notes...

- Head baseball coach Jerrid Oates was selected as the RMAC Baseball Co-Coach of the Year in 2008. In his first season at the helm, Oates led the Orediggers to their first post-season appearance since 1999. The Mines baseball squad also established the third-highest single-season number of victories (20) in program history in 2008.



- Marianne Hutchens has been appointed assistant track & field coach/women's strength & conditioning coach at Mines. Hutchens' husband, Josh, is an assistant wrestling coach at Mines.

- A grand total of 40 Mines student-athletes earned Academic All-RMAC recognition in the spring of 2008 (three in golf, five in baseball, eight in softball, 24 in outdoor track & field).

- For complete schedules, rosters, results and statistics, please visit the Colorado School of Mines Athletics website at <http://athletics.mines.edu>.

## Softball Squad Wins RMAC Regular-Season Championship

The Colorado School of Mines softball team began the 2008 season with high expectations after registering a single-season program record for victories (25) in 2007. Under the guidance of first-year head coach, Annie Van Wetzlinga, the 2008 Orediggers did more than exceed expectations; they achieved the best season in the 26-year history of the program and won the 2008 RMAC Regular-Season Championship.

Picked to finish eighth (out of 12 teams) in the 2008 Pre-Season RMAC Coaches Poll, Mines was ranked as high as sixth in the NCAA Division II South Central Region poll. By the end of the regular season, Mines had finished with the best conference record (27-11) and earned the right to host the 2008 RMAC Softball Tournament. Jackye Lagen was selected to the All-Tournament Team, but a 1-2 mark during the RMAC Tournament brought an end to a season during which the Orediggers established another new single-season program record with 38 wins.

Seven Orediggers were named to the All-RMAC teams in 2008, including Sarah Van Lingen, who was selected as the 2008 RMAC Freshman of the Year. Furthermore, Van Wetzlinga was named the 2008 RMAC Softball Coach of the Year. Just as impressive as their accomplishments on the field, more than half of the Mines softball team earned Academic All-RMAC recognition in 2008, including Van Lingen and Melissa Stratton, who earned First Team Academic All-RMAC honors.

Sarah Van Lingen



## Investing in Mines

An investment in knowledge always pays the best interest.

—Benjamin Franklin

### Copper Club Creates Scholarship

*A Tribute to Phelps Dodge*

A new \$250,000 scholarship fund has been created by the Copper Club to honor the legacy of Phelps Dodge Corporation. The Copper Club is a copper industry professional organization founded in 1944. Their gift will support students in the mining, metallurgy and geology departments who are preparing for careers in the metals field. Andrew Kireta, executive director of the Copper Club, said, “We are proud to recognize and support dedicated Mines students as recipients of the Copper Club’s Educational Grants Program, as they are the future of our industry.”

Phelps Dodge was a major player in the global economy for nearly 175 years; the company was the world’s largest producer of continuous-cast copper rod and molybdenum, and its second largest producer of copper.

It had operations and investments in more than 25 countries, creating everything from cable to specialty chemicals before merging with Freeport McMoRan.

Last year, the Copper Club named former CEO of Phelps Dodge Corporation and Mines alumnus J. Steven Whisler MS '84 its 2007 “Copper Man of the Year” in recognition of his accomplished career. Whisler received an honorary doctor of engineering degree from the School in 2001—the same year he delivered Mines’ commencement address.

Geology Department Head John Humphrey

said, “The resource industries in general, and the copper industry in particular, understand that a key factor in their future successes lies with a technically educated workforce. The Copper Club’s support of Mines students will help ensure a continuing supply of young talent trained in the earth sciences and mining and metallurgical engineering.” He added, “We very much appreciate the generosity of the Copper Club and the legacy of Phelps Dodge in this critical industry.”

For more than a decade, Mines students have benefited from the Copper Club’s 12-school scholarship program. The establishment of this new scholarship exclusively for Mines students is a vote of confidence in the School as one of their most vital university partners.



Fred Marcus Photography

John Humphrey, professor of geology and geological engineering and department head, attended the Copper Club’s event in New York City where the scholarship was announced. Left to right: Andrew G. Kireta, Sr.; John Humphrey; Stephen Higgins; and Arthur R. Miele



# Jody '01 and Adrienne Trantham

*A new face on philanthropy*

Just seven years after graduating, Jody Trantham '01 and his wife, Adrienne, have made Mines a significant philanthropic priority by creating the Houston Orediggers Endowed Scholarship. Trantham, a business manager at ExxonMobil, leveraged the company's exceptional 3:1 matching gift program to direct a total of \$28,000 toward the scholarship, which supports Mines students who demonstrate leadership potential and participate in a minimum of 50 hours of community service annually.

Jody grew up in Alaska and came to Mines because of its outstanding reputation among those who work in the state's dynamic oil and gas industry. A walk-on wrestler with a partial academic scholarship, he worked his way to become a two-time NCAA National Qualifier, ranking sixth in the nation his senior year. Ultimately, an athletic scholarship helped Jody to cover the full cost of tuition. "I was fortunate to graduate from Mines debt-free. By establishing the Houston Orediggers Scholarship, I hope we can help give future students the same opportunity to start



fresh and not have to play catch-up after they graduate," he said.

"Adrienne and I realized that it was time to focus our charitable giving in one direction—toward Mines," said Jody, who attributes their faith as an important part of their motivation to give: "As Christians, it is our obligation to tithe, and we want to be sure our contributions are going toward an organization that benefits young people and helps them to grow—and ultimately give back themselves."

## Reunion Giving Program

At the Graduation Banquet, Marv Kay presented a check to President Scoggins and student trustee Aprilil Nelson representing the reunion giving program's total as of May 1.



Peters Photography

## BP Contributes \$250,000 to Mines; Other Recent Gifts

**Colorado School of Mines recently received two large gifts:**

**BP** contributed \$250,000 toward their pledge of \$750,000 for scholarships and fellowships.

A charitable bequest of \$162,579 was received from the estate of **Mrs. Frances McQuiston** to support the Frank and Frances McQuiston Fellowship Fund at Mines.

**Other recent gifts over \$25,000 from individuals, corporations and foundations:**

**Aqua-Aerobic Systems, Inc.** contributed \$40,000 to support the Advanced Water Technology Center (AQWATEC).

**David Dickson '66** made gifts totaling \$50,000 in support of the David Dickson Endowed Scholarship Fund and The Mines Fund.

**ExxonMobil** contributed \$50,000 to support Mines' outreach to secondary mathematics and science teachers.

**The Harry Trueblood Foundation** contributed \$30,000 toward the Harry Trueblood Foundation Scholarship which supports petroleum engineering students.

**Joe Keating '42**, who spent 24 years in the petroleum industry, contributed \$26,174 to the construction of Marquez Hall.

**Landmark Graphics** contributed \$60,000 to support a graduate fellowship in the Department of Geophysics.

**The Li Foundation** contributed \$42,000 for the Li Foundation Fellowships.

**J. Robert Maytag**, friend of the School, made a gift of \$27,000 in continued support of the Maytag Bolivia Student Support in Metallurgy Fund.

**W. Jones McQuinn '46** contributed \$25,113 in continued support of the McQuinn Endowed Scholarship Fund.

**Laurence S. '39** and **Dorothy Melzer** contributed gifts totaling \$30,000 in continued support of the William and Grace Waldschmidt Scholarship Fund and The Mines Fund.

**Questar Corporation** contributed \$40,000 toward scholarships.

**Glen A. Sweany '61**, MS '62 contributed \$25,000 to establish the George B. Lucas Fund, a new endowment that will provide graduate student support. The endowment is

named in honor of chemistry professor emeritus George B. Lucas who served as a thesis advisor to Mr. Sweany when he attended Mines.

**The Viola Vestal Coulter Foundation** contributed gifts totaling \$73,500 toward undergraduate and graduate scholarships and fellowships, the William Jesse Coulter Instructorship in Mineral Economics, the Mineral Economics Professional Development Fund, the Viola Vestal Coulter Instructorship in Mineral Economics, the Coulter Chair in Mineral Economics, and the Mabel M. Coulter Student Health Center.

**William D. Watts '52** made gifts totaling \$26,031 in continued support of the Fritz Brennecke Memorial Endowed Athletic Scholarship Fund and the Class of '52 Endowed Scholarship Fund.

## STUDENTS

## Chris Peters

Year: **Sophomore**Major: **Chemical Engineering**

When sophomore Chris Peters studies, he has to make the hours count. "I study by myself in the library," he says. On top of a full time academic schedule, he's juggling three jobs and running his own photography company. "I'm never bored," he jokes. Of all his extracurricular activities, photography is the most demanding, the most rewarding and the one he has been doing the longest.

His mother, Janet Peters, first gave him a camera at age 10. An avid rider, she asked her son to take some photos of her on horseback. They came out well, and when Chris learned how

much people were paying for equestrian photography, he went into business—and sold his photos cheap. "That's what [Peters Photography] is...I went in to save people money."

Today his company does equestrian, senior and family portraits, plus numerous photo shoots for Mines. All told, Chris spends around 30 hours a week on his business. Having a presence online has been key: "The website is what made me successful. I don't have my own studio...my shoots have to be done on site," he said, adding that clients can view and order photos directly from his website. While

the profits from his business help out with the expenses of going to school, he doesn't keep it all—a percentage goes to support the Friends Fund and Advocates for Children.

When he's not studying or running his business, Chris divides his time between his girlfriend, working in Vail, being a TA in physics and giving tours to incoming students as a student ambassador. He appreciates Mines, particularly for its size. His girlfriend goes to CU-Boulder. "The teachers don't know Mia's name; they know her student number. My teachers know me, where I'm struggling, and where I'm doing really well," he says.

After he's completed his undergraduate degree in chemical engineering, Chris looks forward to working in the energy industry. A technical career is a natural choice; he comes from a family of engineers. His mother is a chemical engineer, his father, Michael Lupini, is an electrical engineer, and he's already convinced both his sisters, Ali and Emily, to attend Mines: Ali joins the freshmen class this fall, and as for 12-year-old Emily, "She's got it all planned out. She's coming to Mines in seven years, and she's sure about it!" (Learn more about Peter's Photography at [www.peters-photography.com](http://www.peters-photography.com))



## Monica Teff

Degrees: **BS '07, Metallurgical and Materials Engineering, MS '08, Engineering and Technology Management**

Jack and Mary Teff watched with pride as their daughter, Monica Teff '07, MS '08, collected her master's degree from the stage on May 9th, on Kafadar Commons. Although neither holds a college degree, Monica is their sixth child to graduate from university, and the fifth to graduate from Mines. All four of Monica's older brothers are engineers. "I got exposed to the School early," Monica says. "It was a natural decision for me. Minus my sister, Rebecca [a Kansas State University graduate], who is the artistic one in the family, we all liked math and science." Monica's mother is a little more emphatic: "They were all just whizzes at it," she said, adding, "I'm very proud that the School of Mines has taken them all on...We never pressured her. It was her choice."

Monica earned a bachelor's degree in metallurgical and materials engineering and a master's degree in engineering and technology management. However, she started out in chemical engineering, following in her brother James' footsteps. That changed one day. "James gave me a book called *Why Things Break* by one of the professors here [Mark Eberhart] saying, 'This sounds really interesting and I would switch, but I'm too far in.' Sure enough, I switched into metallurgy. I knew right then, that's what I wanted to do." Indeed, Monica has now taken a job working in Southern California as a metallurgist for the Schlosser Forge Company.

Monica's four brothers are John '96, Cody '98, Joe '01 and James '05. And there's another Miner in the family—Cody married alumna Nina (Collongues) '98. All five Teffs thrived at Mines, and perhaps their success is traceable to their growing up working on the family farm in Penrose, CO. Their father says they learned the meaning of hard work long before enrolling at Mines, and there were endless things to fix and problems to solve on the farm. Though they have now all left home, help still comes in the form of advice. "I have an unlimited supply of engineers," he chuckles.

Following the commencement ceremony, Monica's parents remarked on how quickly time has passed. It has been 12 years since they attended their first Mines commencement, when Monica was only 11. "It really went fast," said Mary, who added, "Now we are looking forward to grandchildren." With four to date and such a large family, she's unlikely to be disappointed. And so maybe, in another couple of decades, Jack and Mary will find themselves back on campus to begin another round of Mines commencements.

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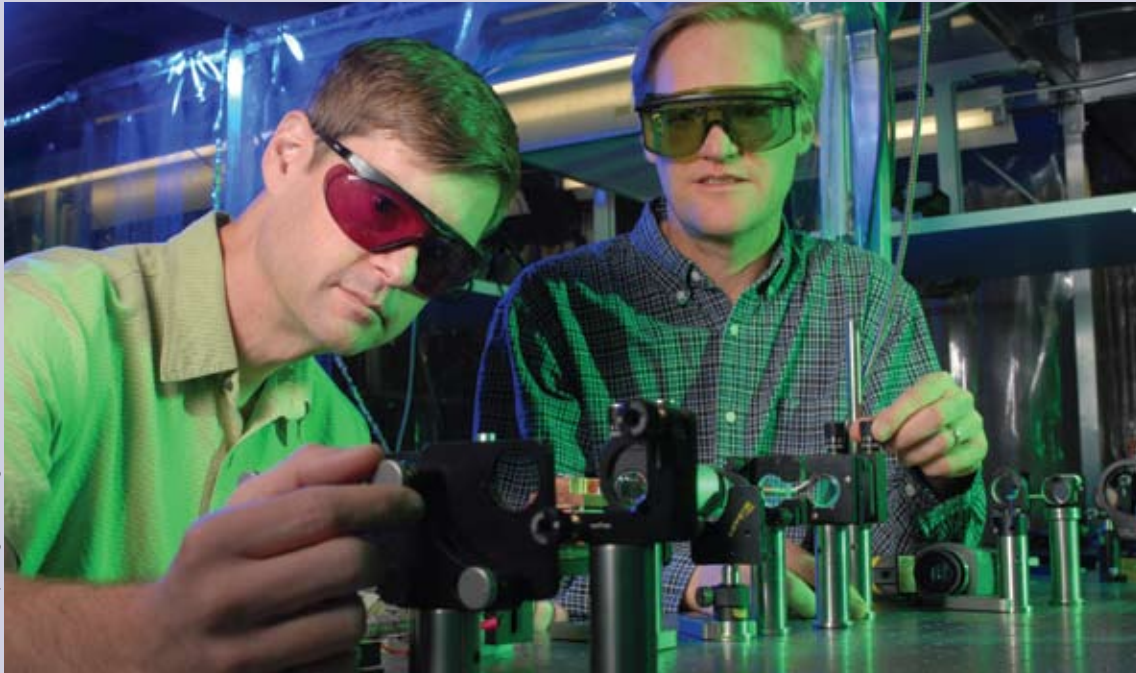


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# FACULTY

## David Marr and Jeff Squier

Research: **Laser Technology**



Thomas Cooper, lightboximages.com

David Marr (left) and Jeff Squier

Jeff Squier and David Marr offer undergraduate and graduate students the opportunity to not only learn about, but also apply their understanding of some important and developing technologies. And they find it gratifying to bring their research into their teaching. "Seeing students in my course grasp and apply new technology is exciting and gratifying," said Squier, a professor of physics. Marr, a professor of chemical engineering, emphasizes hands-on learning in his undergraduate/graduate level microfluidics class by requiring that students fabricate and test microfluidic devices of their own design. According to Marr, the best aspect of being both a researcher and an educator is "the freedom to investigate what I want in an environment populated by vibrant engineers-in-training."

Marr and Squier's complementary backgrounds have led to extensive collaborations on health care-related research projects. They are co-directors of the Center for Microintegrated Optics for Advancing Bioimaging and Control at Mines. Marr's research focuses on employing optical, electrical and magnetic fields to control and direct cells and other materials in micro-scale environments. His techniques allow for the construction of micron-scale devices like pumps and valves, photonic

(light activated) materials, and optical-based separators that are capable of isolating and manipulating individual cells for bio-analysis.

Marr's research is closely tied to Squier's area of expertise—lasers. Squier heads up the Photonics and Ultrafast Laser Science (PULSE) laboratory where he documents events that occur in the femtosecond (less than one-trillionth of a second) time range. Using this technology, Squier designs micromachining lasers capable of making microfluidic devices more compact and useful. For example, lasers cut micrometer-sized channels in the surface of a chip to create pathways that direct cells into testing areas. "Our joint vision is to create a laboratory-on-a-chip for biomolecular spectroscopy, renewable energy research and point-of-care health diagnostics," says Squier. The potential of such a device is particularly evident in health care, where information that currently takes days or weeks to obtain could be immediately available to clinicians in the examining room.

When asked how close they are to realizing this vision, Squier says, "Our first integrated devices produced at CSM with the femtosecond laser micromachining process will be finished by late summer 2008.

# Unleash Your Potential



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# 2008

By Trisha Bentz Kendall

# Commencement



Clear blue skies and Golden's towering mesas provided a spectacular backdrop for the 134<sup>th</sup> Commencement ceremony that took place May 9 on Kafadar Commons. President Scoggins, flanked by faculty in full regalia, welcomed eager students and proud families and friends to campus. A total of 512 seniors crossed the stage that morning to collect their degrees, passing by the flags of the many nations represented by the Class of 2008.

Dr. Daniel Yergin, Pulitzer Prize-winning author of *The Prize: The Epic Quest for Oil, Money and Power*, delivered the commencement address. With oil that day reaching an all-time high, he made predictions on the impact of escalating prices: "It accelerates innovation, it accelerates change and I think oil will lose its monopoly position in transportation...innovation responds to need," he said, adding, "There's an additional reinforcer—climate change."

## Honorary Degree Recipients

**Daniel Yergin:** internationally respected authority on energy, international politics and economics; chairman of Cambridge Energy Research Associates (CERA); executive vice president of IHS, parent company to CERA; Pulitzer Prize-winning author of *The Prize: The Epic Quest for Oil, Money and Power*

**James W. Cronin:** emeritus professor of physics at the University of Chicago; 1980 Nobel Laureate with fellow physicist Val L. Fitch for their discovery of violations of fundamental symmetry principles in the decay of neutral K-mesons

**Mary F. Wheeler:** world-renowned expert in massive parallel-processing; Ernest and Virginia Cockrell Chair in the Department of Aerospace Engineering and Engineering Mechanics, University of Texas at Austin

## Distinguished Achievement Medalist

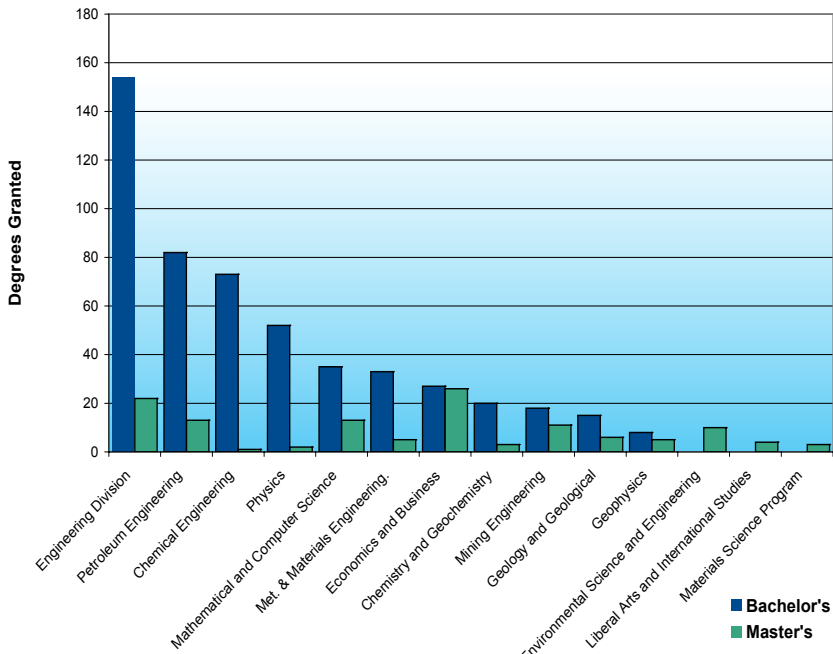
**Vernon A. "Bud" Isaacs, Jr. '64:** chairman and chief executive officer of the RIM Companies

## Mines Medalist

**Charles J. Baroch '54:** mayor of Golden from 2002 to 2008; former executive director of Golden Civic Foundation, president of Hazen Research and chief executive officer of WASTREN



President Scoggins (left) with Daniel Yergin



This graph (above) illustrates the approximate number of bachelor's and master's degrees awarded by each department or division during Commencement 2008. Degrees awarded by the Engineering Division by Specialty: 37 civil, 44 chemical, 10 environmental, 63 mechanical.




At a time of high anxiety when it comes to energy, the Class of 2008 will face no shortage of exciting professional challenges. Yergin spoke to the interesting times ahead, noting, "A week ago when I was working on this speech, oil was \$110 a barrel, today it is \$126." With average one-year placement rates for Mines graduates holding steady around 99 percent, and starting salaries in the \$60,000 range, this year's graduates have ample career opportunities.

Graduating senior Marc Anthony Guerra reflected on the Mines experience during his student address. "Time and time again, we're told how prestigious this school really is... the students, the faculty, the staff and the graduates before us made Colorado School of Mines what it truly is today."

Celebrations had begun the night before commencement, as more than 500 guests filled the Student Recreation Center for the Graduation and Alumni Banquet. Student, faculty and alumni award presentations kicked off the festive occasion. Keynote speaker and Nobel Prize-winning physicist James Cronin congratulated graduates on their achievements and spoke on the importance of science to society's welfare.

As the Class of 2008 joins the extended community of Mines alumni and is welcomed by industries eager for their skills, the future looks bright for next year's graduates as well—all 185 Fall Career Day booth spaces were sold out less than three days after registration opened. Such tremendous demand for Mines graduates is a powerful testament to the School's relevance in these complex and challenging times.

(Daniel Yergin and James Cronin's speeches are available under "Web Extras" on the *Mines* magazine website: [www.mines.edu/magazine](http://www.mines.edu/magazine).) 







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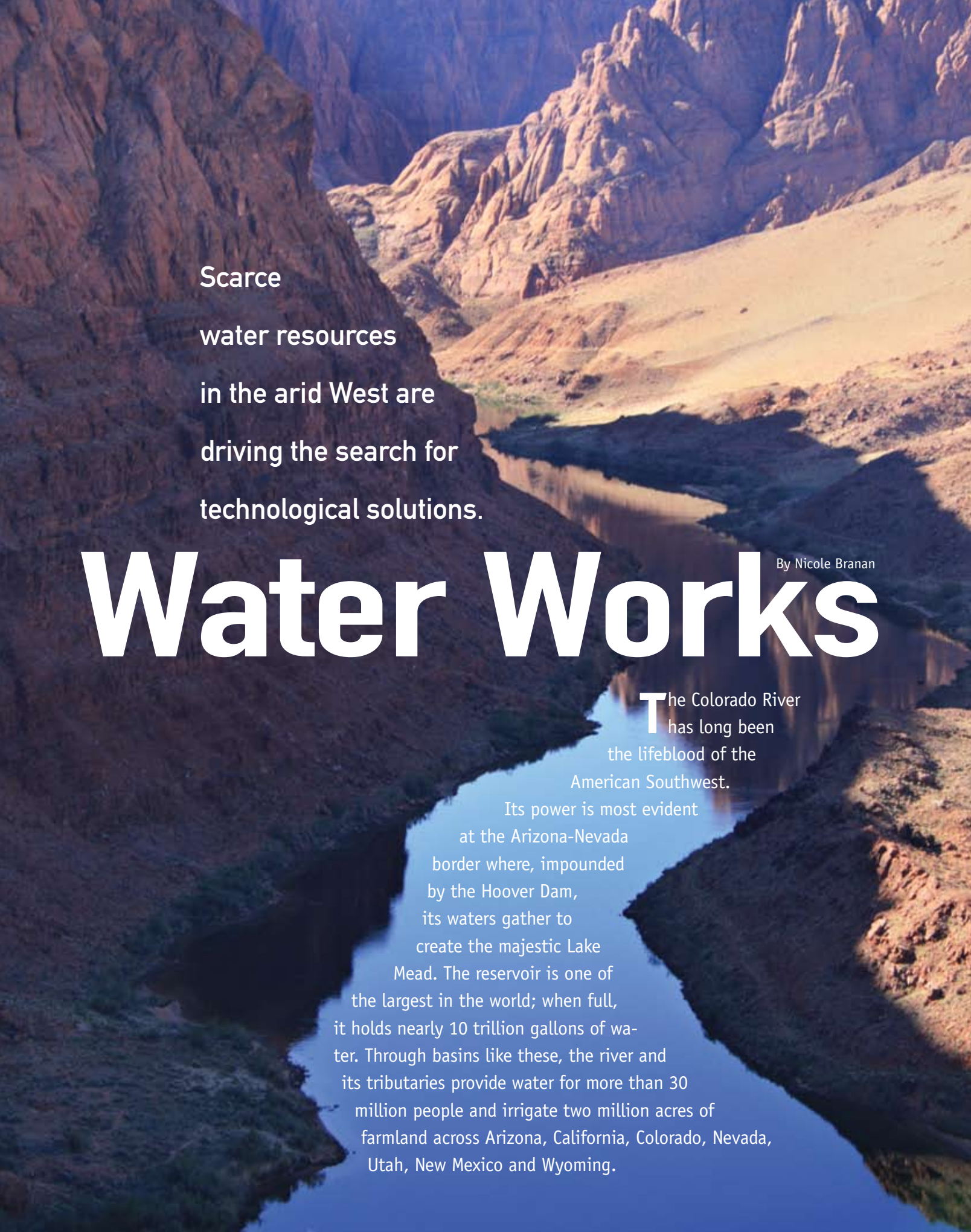
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Scarce  
water resources  
in the arid West are  
driving the search for  
technological solutions.

By Nicole Branan

# Water Works

**T**he Colorado River has long been the lifeblood of the American Southwest.

Its power is most evident at the Arizona-Nevada border where, impounded by the Hoover Dam, its waters gather to create the majestic Lake Mead. The reservoir is one of the largest in the world; when full, it holds nearly 10 trillion gallons of water. Through basins like these, the river and its tributaries provide water for more than 30 million people and irrigate two million acres of farmland across Arizona, California, Colorado, Nevada, Utah, New Mexico and Wyoming.



Thomas Cooper, lightboximages.com

Clockwise from top left: AQWATEC staff, Dr. Chris Belton and John Luna, reload a nanofiltration membrane into a pilot-scale skid at a water reuse facility in California. Gretchen Oldham, a graduate research assistant, simulates the mechanisms of riverbank filtration in small-scale column systems. Nathan Hancock, a doctoral student, and Professor Tzahi Cath adjust a 1,000 gallon tank that is used to provide water to pilot-scale membrane units.

But the Colorado and other water resources in the West are becoming overtasked. In the future, a warming climate will likely shorten snow seasons, cause runoff to start earlier and send more moisture skyward through evaporation, rather than downstream as melt. Climate models predict a reduction of Colorado River flows ranging from 5 to 50 percent by mid-century, says Brad Udall, director of the Western Water Assessment program at NOAA's Earth Science Research Laboratory. Recent drought conditions have already taken their toll; Lake Mead and Lake Powell have both dropped to about half their levels over the past eight years. And a lot more people will draw on these water resources in the coming decades. The U.S. Census Bureau projects the country's population will double by the end of the century, with the highest growth in the West and Southwest. Not only will all these people drink water, take showers and wash their dishes and clothes, but they will also need power. And energy generation requires about five times as much water per person as direct water use does, says Jörg Drewes of the Colorado School of Mines Environmental Science and Engineering Department.

"When you combine all these factors, you see that you have a very serious problem," Udall says, voicing the widely held opinion among his peers that we can't continue with business as usual if we want to avert a water crisis. Tackling this issue will obviously involve efforts to limit demand through more efficient use of existing resources. But given the anticipated population growth in the arid West and Southwest, what can be done to boost supply?

Researchers at Mines believe non-traditional water resources can

be part of the solution, two of the most promising being wastewater from municipal water treatment plants and co-produced water from oil and gas production. Every day billions of gallons of wastewater cycle through treatment plants in US cities; capturing, purifying and sending it back for reuse would add substantially to supplies. And extracting oil and natural gas from geologic formations also involves extracting huge volumes of water. Making use of these and other non-traditional resources would steer the region away from relying entirely on uncertain precipitation patterns. "Water supply is like an investment portfolio," Drewes says. "You don't want to have all your money in one stock."

But unlike runoff from pristine snow, these water resources contain a wide range of contaminants, and making them fit for domestic or agricultural use at low cost and with high efficiency requires new ideas, approaches and technologies. That's a big challenge, but one that Mines researchers such as Drewes have been eager to take on.

Last fall, Drewes and his colleagues redoubled their work in this area by launching the Advanced Water Technology Center, or AQWATEC. The new center's faculty, staff and students work on developing decentralized water treatment facilities, making current water treatment processes more efficient and designing new ones. Drewes points out that Mines has a strong track record in water technology and water reclamation research, and with a growing number of scientists at the School working in the same or complementary fields, he felt they had a critical mass of expertise to establish the center.

To get at oil and gas resources, two billion gallons of water are pumped from the ground every day across the United States. “That’s more than the daily water consumption of New York City and Los Angeles combined,” says Tzahi Cath, an assistant professor of environmental science and engineering and member of AQWATEC. Moreover, from the perspective of the fossil fuel industry, this water is a waste product and getting rid of it is a big headache. High concentrations of salts, hydrocarbons and other contaminants usually rule out discharge into rivers, so often the only alternative is to inject it back into the geologic column. But that’s only feasible if a suitable reservoir is nearby, and even then such operations are very expensive. “Often producers start pumping and when they see the quality of the water they say ‘No, thank you, it doesn’t make any economic sense to develop this well and we’ll just close it,’” Cath says. However, with appropriate treatment technologies, this water could be used for agricultural, industrial or domestic purposes, allowing oil and gas producers to make money selling it. “You can view this water as a waste product or you can view it as a revenue stream,” Drewes says, adding that the opportunities for the Southwest are enormous, since about 80 percent of the country’s natural gas is produced in the Rocky Mountain region.

With a four million dollar grant from the Department of Energy and an industry consortium, AQWATEC is developing technologies that can handle large volumes of coproduced water with a wide range of contaminants in varying concentrations. “The type of water can change from one well to another, even within the same basin,” Cath says. And because natural gas fields are usually isolated, without infrastructure or trained operators to supervise around the clock, AQWATEC is designing these technologies to be self-operated, Cath adds.

At the heart of these processes are membranes with pores just wide enough to let water molecules through, leaving most salts and other contaminants behind. Conventional polymeric membranes often yield high quality water, but pushing water molecules through the tiny pores requires high pressure—and therefore lots of energy. In addition, the corrosive water found in geologic formations would quickly clog up and foul these delicate membranes, Cath says, adding that the same is true for other saline water resources, such as the ocean.

To circumvent this problem, AQWATEC develops hybrid systems that include pre-treatments with novel sturdy ceramic membranes that can handle some pretty nasty solutions. They then route the pre-treated water through processes that run at relatively low pressures, such as nanofiltration. By arranging the individual treatment steps in specific sequences, the team takes advantage of natural driving forces, minimizing energy input. Such hybrid systems can purify and recover more than 80 percent of the water volume, making it fit for agricultural or potable use, depending on its original quality and the treatment process used. The remaining water contains high salt concentrations and could be a resource of high market value. “For example, there might be silica or other valuable minerals in this waste stream that could be separated out and sold,” says Cath.

One of the advantages of coproduced water is that it is a drought-proof supply. This is also true for another non-traditional resource that AQWATEC is focusing on: municipal wastewater. Cities generate millions of gallons every day; treatment plants along the Front Range, for example, release so much wastewater into the South Platte River that this historically intermittent stream now flows year-round. Re-using this

## AQWATEC

We wouldn’t be able to live without water to drink, but we wouldn’t be able to generate energy either; power plants consume enormous amounts of water for cooling and driving steam turbines. AQWATEC is developing new technologies to optimize these processes by taking advantage of waste heat to clean up and recover water. As steam is driven off, the water in systems used for cooling and driving turbines gets more and more concentrated with salts and minerals. To avoid corrosion in plumbing systems, operators discard large quantities of salty water as waste, explains Tzahi Cath, assistant professor of environmental science and engineering. In an effort to recover some of this water, AQWATEC is developing a system that routes warm salty cooling water through a heat-driven membrane distillation process. Running a stream of warm brine down one side of a specialized membrane and cold, fresh water on the other creates a vapor pressure difference, causing water vapor to separate from the brine, diffuse through the membrane and condense on the other side. “Then you can send this purified water back to the cooling towers,” Cath says. Because this process is driven by heat, no pressure is needed.

If modified, the technology could also remove gases, and that’s important because the water that comes back from cooling towers is highly saturated with oxygen, making it very corrosive, Cath says. If this water is injected into the ground, operators usually use chemical treatments that pull out the oxygen to save well casings. Researchers at AQWATEC are testing a specific membrane distillation system that can remove oxygen, eliminating the need for chemicals.

Membrane distillation can even extract pure water from the stream of brine that geothermal power plants usually inject back into the ground after extracting heat from it. Such water could be routed to cooling towers, eliminating the need to tap into any other water resources, Cath says. That can be particularly useful in areas where not enough surface water is available nearby, Cath says. “Membrane distillation is a very versatile process and we can use waste heat to drive it.”



Nathan Walker, a graduate research assistant, is testing membrane distillation as a novel process to treat brine from geothermal power plants.

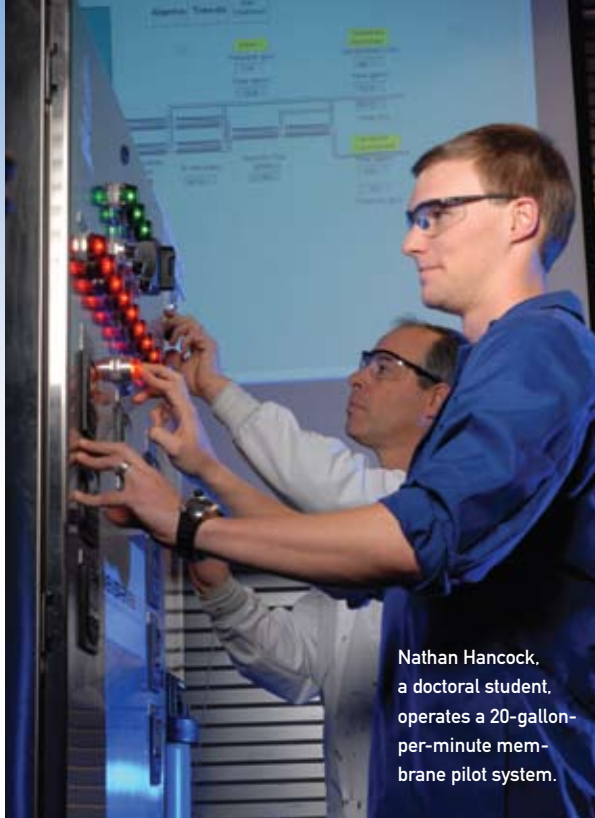
water rather than letting it drift downstream would allow rapidly growing cities along the South Platte to keep up with rising demand. But this water is heavily contaminated with chemicals from household cleaners, personal care products and pharmaceuticals, Drewes says. "These are problematic substances and they are not entirely removed during the treatment they go through before entering the South Platte."

However, the fact that they are streaming down a river provides a unique opportunity to remove them. Sediment banks flanking waterways are an important part of the global hydrological cycle and they act as an excellent filter. Microbes that live in the soil eat up contaminants as wastewater slowly trickles through, and because the water is pulled by gravity, such systems require no extra energy input. "That means that if you take advantage of this natural process, you can improve water quality substantially at virtually no cost," Drewes says.

That's the idea behind riverbank filtration, a process that involves drawing up water through deep wells close to the river after letting it percolate through soil. Riverbank filtration is a critical element of the city of Aurora's Prairie Waters Project that will extract and clean water from the South Platte River. AQWATEC researchers played an integral part in designing the project, which is scheduled to come online in the summer of 2010 and which could contribute up to 20 percent of Aurora's water supply.

Riverbank filtration has been used for decades, particularly in Europe. But every subsurface is different and determining the right parameters, such as travel time and well distance from the river, is crucial to get the process to work, says Ted Hartfelder, project manager with the city of Aurora. To obtain this information, AQWATEC researchers partnered with the city of Aurora and the AWWA Research Foundation, and Drewes' team simulated the entire process, hauling in water from the South Platte and running it through soil columns in the lab. In addition, the team monitored a demonstration site with 15 wells in the Brighton area and gathered data from other riverbank filtration projects in Iowa and Kentucky. From that, the team determined the mechanisms by which contaminants were removed and how quickly they worked. "We used the data that the team came up with for the design of the project," Hartfelder says.

Although riverbank filtration removes the majority of contaminants, it doesn't get rid of everything. That's why the city routes water from the wells into an advanced treatment facility. Here it is first softened, then treated with ultraviolet light and hydrogen peroxide, then filtered, and finally sent through an activated carbon adsorption system. After disinfection, the water is blended with the city's current supply. Lining up all these different processes adds a lot of additional barriers that each target different types of contaminants,



Nathan Hancock, a doctoral student, operates a 20-gallon-per-minute membrane pilot system.

Drewes says. "There is pretty much no chemical that can survive this type of treatment."


That's saying a lot because some compounds can be incredibly persistent. The antiepileptic and anti-depression drugs primidone and carbamazepine are two examples. When Drewes and his team tracked the plume of wastewater discharge at a facility in Arizona, they could still detect both pharmaceuticals at the parts-per-trillion concentration level after eight years. However, these drugs don't survive Aurora's Prairie Waters Project's oxidation process, Drewes says.

Nevertheless, water utilities are still dealing with a lot of unknowns because scientists can currently only identify a very small number of the chemicals and pharmaceuticals that make it into

municipal wastewater. "We're talking 500 or 1000 at best, but there are thousands more out there," Drewes says. Part of the problem is that these compounds are present in extremely low concentrations, equivalent to a fraction of a drop dissolved in an Olympic-size swimming pool. Analysis at that level is not only very expensive, but it also requires high-end instrumentation that only a handful of labs in the country have. This is further complicated by the fact that new household chemicals and pharmaceuticals hit the market every day, all of them ultimately making it into wastewater.

"If you target your analysis towards widely prescribed drugs, such as blood lipid regulators that people take on a daily basis, then I promise you that you will find them in the water," Drewes says. While it is important to remember that the concentrations of these compounds in wastewater are invariably a tiny fraction of prescription doses, long-term effects of exposure are unknown. Furthermore, a warming climate that might bring with it less precipitation and more evaporation will also likely concentrate these compounds, particularly as population densities increase, Drewes says.

Since it would be impossible to constantly sample the water and test for all these chemicals, AQWATEC researchers are developing theoretical models to predict the fate of individual compounds in the treatment process based on their structure and chemical properties. "That way, if there is a new compound coming down the pipe that hasn't been identified before, all we have to do is look at its molecular structure and feed that information into our model. That will tell us, for example, 'Okay, don't worry, this compound is going to get removed by 95 percent in this particular treatment step.'"

As supplies shrink and many regions across the West and Southwest become hotspots for potential water crises, engineered solutions such as those that AQWATEC is developing will be crucial. And that is true for the entire globe, Drewes says. "The water crisis that we are facing is very much present in Australia, Africa, the Middle East and other places, so our approaches will be broadly applicable." 

# RAA

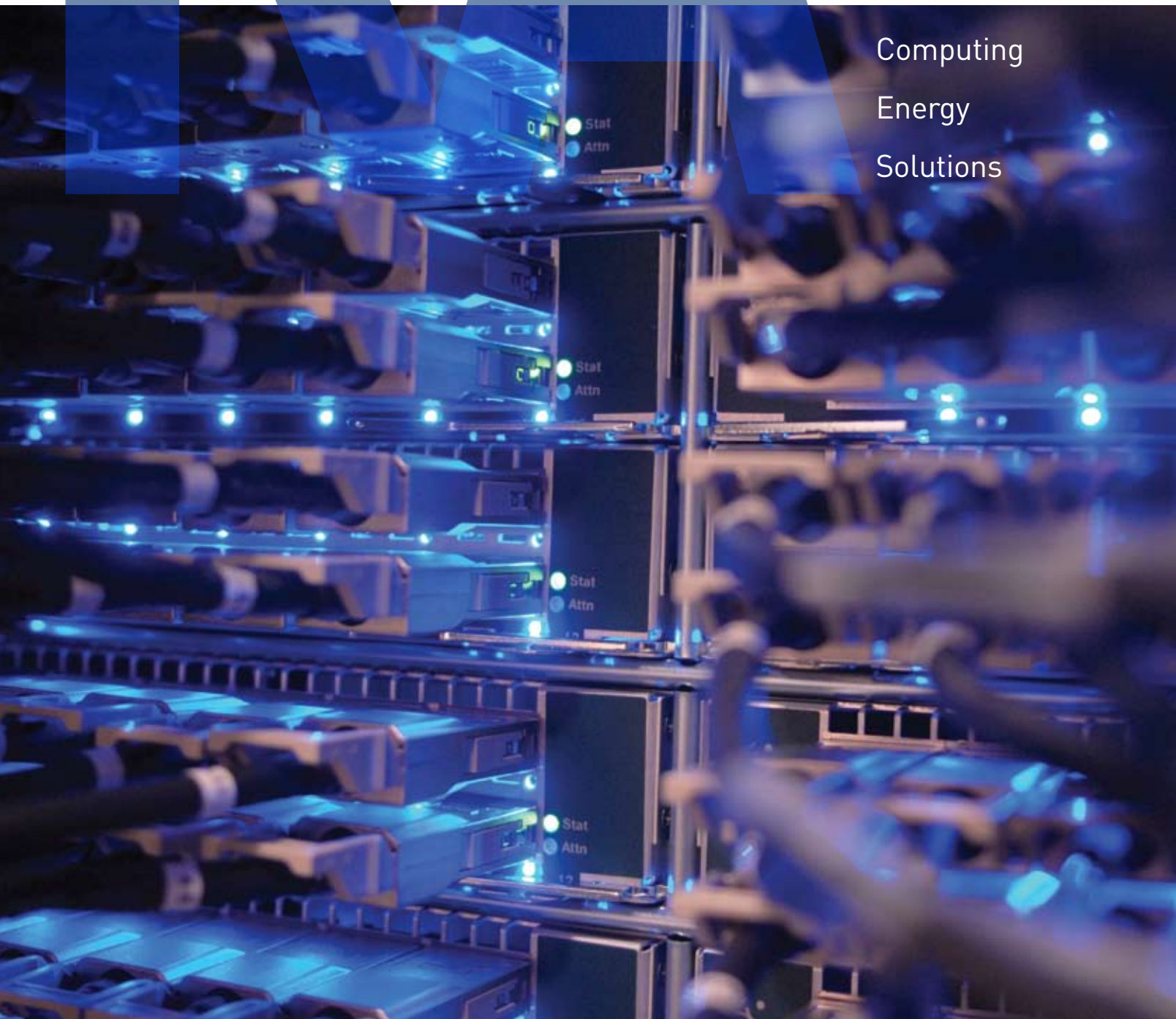
By Nick Sutcliffe

# Power

Computing

Energy

Solutions



On the computer screen, an amoeba-like structure is floating above a dense lattice of atoms. “We’re putting this molecule on the surface of a semiconductor to change how it responds to light,” said Mark Lusk, a professor of physics at Mines. “Our aim is to use light to split water and make hydrogen. The key is to get this molecule to hold tightly enough to the semiconductor, and we want to know how this particular molecule bonds.” As the gangling molecule finds the surface of the semiconductor, it sucks in a titanium atom. “That’s how,” says Lusk, pointing to the newly formed bond.

Interesting. But what is really interesting about this experiment is that it didn’t actually take place—the molecule didn’t exist, nor the semiconductor. Lusk’s experiment was conducted entirely within a virtual reality. He set up the scenario using specialized software, placing the molecule above the semiconductor. From there the computer calculated the outcome by applying the laws of quantum mechanics, essentially accounting for the incremental movement of every single electron within each atom in the system.

Although it wasn’t “real,” Lusk maintains that the experiment theoretically played out just as it would in reality. “We don’t use the words ‘modeling’ or ‘simulation,’ for this work,” said Lusk, “because they tend to conjure up an undue sense of approximation. Here it’s truly a virtual reality, with the kind of quantitative accuracy that we need to design at the atomic scale.” He recalled another virtual experiment in which a molecule kept falling apart. Coincidentally, his colleague Andy Herring, an associate professor of chemical engineering, had encountered the same problem in his lab while trying to create the molecule physically. After talking through the possibilities, Lusk and Herring “virtually” solved the problem by getting a similar molecule to bind to a surface and then swapping in the correct atoms after the fact.

Creating such virtual realities for even a few hundred atoms requires an astronomic number of calculations. For example, Lusk’s water splitting experiment involved around 200 atoms. Nevertheless, running on the equivalent of four powerful desktops, it still took nearly two weeks to calculate the outcome.

And Lusk is not alone. Computers are playing an increasingly central role in science and engineering. Before building a prototype, launching a lengthy laboratory experiment or recommending changes in government policy, scientists are increasingly relying on computer models to predict possible outcomes. Not surprisingly, as these models grow in sophistication, scientists’ appetite for computing capacity grows. As Lusk quips, “It turns out reality is complicated.”

Mushrooming demand for computing capacity has created bottlenecks. If a scientist wants to run an experiment on a supercomputer, it often means submitting a proposal and then, if accepted, sitting in a queue for hours at best, and often days. “Folks end up focusing on scientific questions that they have the power to answer within

a reasonable period of time. The result is that the lack of computer resources limits our research ambitions,” says Lusk.

However, for some researchers at Mines, these limits are about to be expanded thanks to the arrival of a brand new high-performance computer on campus. Ranking among the top 150 fastest supercomputers in the world, the new system has a peak operating speed of 23 teraflops (23 trillion operations per second, or 4,000 calculations per second for every man, woman and child on Earth). It was brought to campus under the auspices of the newly formed Golden Energy Computing Organization (GECO), a partnership between Mines, the National Renewable Energy Laboratory in Golden, the National Center for Atmospheric Research in Boulder and the National Science Foundation.

Dedicated to energy-related science, the computer has been nicknamed Ra, after the Egyptian sun god. For the immediate future, priority use will be given to projects tied to eight specific challenge topics that fall in one of four categories: developing renewable resources, finding new natural resources, enhancing environmental stewardship and designing new materials. In setting these priorities, GECO has sought balance: “The Mines energy portfolio is broad. We believe that society must carefully consider all energy options. This means that both existing resources and renewable resources need to be pursued, and responsible energy science must forecast the impact of potential solutions on local environment and global climate. Our key investigations reflect this mindset,” says Lusk, GECO’s director.

One project soon to get underway concerns the nucleation and growth of natural gas hydrates. Hydrates are crystalline water structures that can encase small hydrocarbon molecules. When transporting natural gas in pipelines, certain conditions can lead to the nucleation and growth of these crystals, which if they get big enough, can

Left to right: Michael Robbert, high performance computing and networking engineer; Tim Kaiser, director of high performance computing services; and Mark Lusk, director of GECO and professor of physics next to Mines' new supercomputer, "Ra."



plug and shut down an entire pipeline. Removal is extremely expensive and dangerous, so operators would very much like to avoid their formation in the first place.

On the other hand, natural deposits of hydrates in ocean sediments and permafrost around the world represent a very large potential energy source—at least twice all proven natural gas reserves according to Carolyn Koh, an associate professor of chemical engineering who helps head up the Mines' Center for Hydrate Research. Koh explains that a better understanding of hydrate nucleation could be helpful for extraction of this valuable natural resource.

To better understand how crystals form and dissolve, Ra will help model the molecular interactions between water and methane. "If we can simulate the nucleation and growth of methane hydrates, we can control their formation in pipelines. The goal is a dynamic model that provides operators with the exact conditions for plug formation and dissolution," says Koh. She also points out that another significant outcome from this research might be a means of growing hydrate crystals around hydrogen molecules, which could ultimately lead to a safe and stable means of transporting hydrogen.

Ra will also support research into one of the most hotly pursued goals in the biofuels arena: the economic manufacture of ethanol from cellulose. Cellulose is the fundamental building block of the plant kingdom and the most abundant organic compound on Earth. Though it is a complex polysaccharide composed entirely of glucose—the key raw material needed for ethanol production—its tightly bound crystalline structure makes it extremely hard to break down. Using heat and sulphuric acid it can be artificially accomplished, but this approach significantly increases the cost of the end product. Instead, scientists are looking into how a naturally occurring enzyme might be used to lower costs.

Cellulases are a family of enzymes found primarily in fungi and bacteria that are capable of breaking down cellulose into simple sugars. Mike Crowley, a research scientist at NREL, explains that this takes place in two-stages: first the enzymes pry long chains of sugars away from cellulose fibers, then they snip the chains into disaccharide (two-sugar) molecules. However, with naturally occurring cellulase, this process happens too slowly to be economically viable. "If nature has already optimized the process, there's nothing we can do to speed things up," Crowley explains. "But nature might have come up with an enzyme that is slow on purpose... an enzyme that acts too fast might destroy most of what the plant world relies on for its structure, killing its host. If this is the case, we have a fighting chance of speeding things up and making the process economically viable," says Crowley. To find out, he and his colleagues will model cellulase interacting with cellulose, looking for hotspots of activity along the enzyme as the reaction is simulated. They will then share

this information with experimentalists who will chop and change cellulase in a conventional lab to try to speed up its reaction time.

The experiment involves a large number of variables. "Once we put everything together—the enzyme and cellulose surrounded by water—we end up with a system of several million atoms," says Crowley. That's too many to simulate using Lusk's approach with his water-splitting research—even on a fast computer like Ra. Instead, Crowley's models are grounded in classical molecular mechanics, which computes outcomes based on Newtonian physics, with atoms treated as particles connected together by complex springs simulating physical bonds. While Lusk runs his experiment in time steps that are fractions of an attosecond—a billionth of a billionth of a second—the molecular mechanics approach jumps progression up to femtoseconds—a mere millionth of a billionth of a second. "If you want to consider materials composed of millions of atoms and a second or more of virtualization, this is the only way to do business, and a very powerful computer is still a necessity," says Lusk.

Ra may also accelerate research into polymer batteries. Batteries and hydrogen are seen as the two best options to replace hydrocarbons in transportation; weight, safety, cost and charge/discharge times are the key issues to overcome. "New light-weight, high capacity batteries could tilt the playing field in favor of a purely electrical solution," says Lusk, which in turn could catapult nuclear power into the role of powering our cars as well as our household appliances. Advances in battery technology could also increase the contribution of wind and solar power generation systems to our overall electricity portfolio by providing an effective power storage option.

Another research focus on GECO's short list concerns improving semi-conductors—the materials that make up the critical circuitry of almost all electronic devices. Cristian Ciobanu, an assistant professor of engineering who specializes in this field, explains that silicon has long been the semi-conductor of choice, and for decades chips have been shrinking as they get evermore powerful. However, Ciobanu explains that this trend is slowing. "We have almost reached the



## Ra and GECO are on track for changing the way energy science is conducted and taught at Mines.

natural limitations of silicon. We can't make devices much smaller or much faster using silicon as the semiconductor," he says. "To do that, we will have to replace the silicon chip with advanced materials that beat the limits that silicon has reached."

Ciobanu is one of many scientists around the globe seeking to address this problem, and he's primarily relying on computer simulations to explore the possibilities. The material with the greatest potential is carbon. "Single-atom carbon layers have electron mobilities that are about 10 times larger than those achievable in the best silicon wafers," says Ciobanu. In other words, if we can replace silicon chips with carbon chips, computers and other electronics could run much faster and use only a small fraction of the electricity, because the electronic conduction is nearly dissipation-free in graphene. Given that about 10 percent of electrical power in the U.S. is used by household electronics, improvements in efficiency could significantly reduce this nation's electricity bill.

The science so far described represents a significant portion of the research that Ra will support; computational inquiry at the nanoscale has enormous potential to solve problems of global significance. However, Ra will also be put to work on problems involving much larger systems: atmospheric scientists at the National Center for Atmospheric Research plan to use Ra to interpret global climate systems, while geophysicists and petroleum engineers at Mines will use Ra to probe deep into the earth.

Lawrence Buja, an NCAR scientist, explains that NCAR joined the GECO partnership to facilitate a shift in their global climate modeling work. "The question of whether or not climate change is attributable to human activity was put to rest several years ago," says Buja. NCAR is now "moving away from simply simulating whether or not climate change is occurring, to carrying out detailed simulations addressing critical adaptation and mitigation issues." Ra will be used to run some of these simulations, which will involve close collaborations between researchers at NCAR and Mines. Buja explains that climate is the result of a complex interplay of conditions in the atmosphere, at the Earth's surface and in the subsurface. In addition to providing a valuable computing resource, NCAR scientists see GECO as providing the opportunity for collaboration with Mines faculty on topics relating to the carbon cycle, options for carbon sequestration, paleoclimate analysis, geology and other aspects of subsurface science.

Ra is likely to impact subsurface science on campus as well, particularly in the search for new fossil fuel reserves and enhancing recovery techniques. Paul Sava, assistant professor of geophysics, says he's looking forward to working with sponsors on larger datasets and exploring new modeling techniques, in particular Monte Carlo optimization. This approach yields significantly enhanced subsurface images by incrementally refining a model between successive simulations of the same dataset. "From each simulation you learn something, and you can make slight modifications to the model," says Sava. He explains that it can sometimes involve as many as 1,000 simulations. "We are happy to complete one simulation with our current computing capacity," he adds. Sava is also optimistic that access to Ra will

attract more interest from graduate students. "Experience working with a computer of this scale is very valuable," he says.


GECO's board recognizes this value and has defined clear educational and outreach objectives. Lusk explains that while GECO will directly facilitate energy research, the organization will indirectly support energy science by providing students going into the industry with an education in high-performance computing. "This particular machine will address only a small fraction of the energy science questions that will be pursued by those that the machine helps to educate," he says.

And there are plenty on campus eager to learn. GECO's first high-performance computing training class held in June was oversubscribed. "We had almost four times as many people sign up for the class as we have space for," said Tim Kaiser, who joined Mines in April as the school's first director of high-performance computing. Starting this fall, classes in high-performance computing will be offered every semester at the graduate and undergraduate levels. And a minor in high-performance computing is also planned for postgraduate students.

Outreach is an important component of the organization's mission. Specifically targeting under-represented groups on and off campus, GECO will offer educational and training opportunities to members of the Mines chapter of the Society of Women Engineers, and to students at the Salish Kootenai College on the Flathead Indian Reservation in Pablo, MT, which recently established a bachelor's degree program in computer engineering.

Ra is about seven feet tall with a footprint 24 feet long and three wide. It is housed in the basement of the Center for Technology and Learning Media where air conditioning systems blast 24 hours a day, making the front side of the computer stack feel like a walk-in refrigerator. By contrast, the air that percolates through the stacks of 2,144 computer cores feels more like it is coming out of a large hairdryer.

Not surprisingly, the system consumes a large amount of electricity—100 kilowatts at peak operation. Since sudden loss of power could damage the hardware and destroy weeks of research data, backup power systems are essential. There are three battery units in the basement, each the size of two large domestic refrigerators, which can keep things running for about 15 minutes. Outside the building, a diesel generator large enough to power the entire system is designed to automatically activate within 30 seconds if power from the grid is cut.

"It is a little ironic that we need a device that uses so much energy in order to support research into better ways to use energy," says Lusk. "But that is the nature of this game—investing time, money, and yes even energy, to discover new ways of meeting the energy needs of our society," he says. Ra and GECO are on track for changing the way energy science is conducted and taught at Mines. The results may change where our domestic energy comes from, the kind of cars we drive in the years ahead and the climate in which future generations will live. 

# The Network



Tim Marquez '80, speaks at Golden Lunch Bunch.

## Reunion 2008

Held May 8-10, Reunion 2008 was a fun-filled three days that included a series of traditional events combined with several new additions to the program. Celebrating their 50th reunion, members of the Class of 1958 were welcomed on Wednesday evening with a reception in the gleaming new Student Recreation Center. This was followed the next morning by the traditional 50th Reunion Breakfast hosted by President Bill Scoggins and his wife Karen. Scoggins spoke appreciatively of

the class' many contributions to society made in the years since leaving Mines, before presenting them with commemorative diplomas to mark the occasion. The event wrapped up with a slideshow of photographs from their days at Mines in the mid-fifties.

Other classes attending Reunion 2008 chose from an action-packed program of activities. New tours and events included the Colorado Fuel Cell Center and new Student Recreation Center. And old favorites were the National Earthquake Center and the Geology Trail Walk. Alumni attended several events, including the Graduation Banquet

where Nobel Laureate Jim Cronin spoke to a crowd of over 500; the Golden Lunch Bunch, where philanthropist Tim Marquez '80 spoke of his commitment to education; a symposium on energy led by several Mines faculty members; several departmental receptions; and of course the class dinners where many old friends were reunited. The success of Reunion 2008 can be chalked up to a strong turnout, careful planning and a lively program—Reunion 2009 will get the same level of attention, so mark your calendars now for May 6-9!



Reunion 2008 ended with a "pignic."



### Class of 1958

Names listed left to right: Back Row: **Stanton Hadley, Channing Welin, William "Bill" Wahl, John Nesbitt, Robert Barker, Charles "Tom" Brown, and Douglas P. Hildenbrandt.** 4th Row: **William Preston, Dan Bench, James Natland, Ronald "Ron" Wahl, Donald Myers, Bruce Russell, Roland Shubert** 3rd Row: **James Mollison, Richard Volk, William Kelsay, Ralph Marsh, Jerome Gamba, Robert H. Zimmerman, Peter Bowen** 2nd Row: **Robert Waterman, Gerald "Gerry" Grimes, Vincent Wood, Raul Maciel, Hershal Ferguson, Olin Whitescarver, R. "Stan" Rickard, Robert Moston, Robert Hartmann** Front Row: **Benson Joseph, Augustine "Gus" Ludwig, Myron Buchanan, Fr. Paul Meaden, Jon Hamlin, Donald Wilson, William "Bill" Bruce**

## Life Members

The Alumni Association gratefully acknowledges its new Life Members listed below. This list includes members welcomed between Nov 1, 2007 and May 31, 2008.

Michael L. Armentrout '95  
Leanne M. Baker MS '81, PhD '84  
Michael E. Baldus '84  
Dorena J. Battaglino '91 and  
Nicholas J. Battaglino III '90  
Chrys D. Beal '76 and Kelly S. Beal '76  
Christopher L. Beato '86  
Brooke S. Bell '80  
Michael D. Biggs '80  
Scott S. Birkmire '97  
Renata J. Bollich '87  
Forest J. Bommarito '03 and  
Olivia O. Bommarito '03, ME '05  
Deborah L. Bouvier '83  
Jaymie L. Brain '99 and  
Russell A. Brain '99  
Ronald L. Brinkman '76  
Donald W. Bucholz PhD '99  
Noelle R. Cochran '86  
Dave O. Cox '74, MS '77  
Jennifer E. Day '90 and Joel T. Day '95  
Avis A. Downey '76 and  
Robert A. Downey '76  
Erme Enriquez MS '96  
Mark A. Erickson MS '95  
William H. Foard '70 and  
Catherine B. Foard '71  
W. Dennis Gibson '76  
Noel H. Ginst '81  
Ronald L. Gist '70, MS '72

Joe W. Gray '68  
Mark R. Gwaltney '93 and  
Julia C. Gwaltney '93  
Timothy J. Haddon '70  
Michael C. Hankins '79  
David K. Hartner '68  
Todd M. Harwood '92  
Matthew J. Hazleton '05  
Scott E. Highbarger '00  
Murray W. Hitzman and  
Maeve A. Boland PhD '05  
Hans C. Hoppe PMP '92 and  
Cynthia C. Hoppe '92  
George F. Hunsaker '85  
Matthew K. Johnson '96  
Michael J. Johnson '96, MS '98 and  
Debra Pacas Johnson '96, MS '98,  
PhD '07  
Travis N. Johnson '03  
Erik Keskula '96 and  
Pamela J. Keskula '96  
Jon M. Kilikewich '97  
Nicholas R. Kimball '01 and  
Amanda K. Kimball '02  
Joshua R. Lamb '04 and  
Michelle M. Lamb '98  
Cindy M. Lee PhD '90  
Christopher P. Leone '95 and  
Katryn S. Leone '96  
Margaret A. Lessenger '81, MS '88,  
PhD '93

Kimberly M. Lewis '92, MS '03  
Christopher E. Lindeman '04  
Clifford R. Lippitt '75, MS '80  
Michael P. Long '89  
Scott A. Malson '86  
Katherine A. McCarville MS '85  
Kathleen M. McDermott '83  
Michael K. McKenty '80  
Keith W. Melcher '91 and  
Helen E. Melcher '93  
Deborah L. Mink '07  
Jose L. Moreno '96  
Francis O. Mueller '53  
Timothy J. Murphy '77  
Aprill M. Nelson '08  
Roger A. Newell MS '71  
Cynthia Wood Newton '84  
Kim Van Thi Nguyen '03  
Victoria B. Jackson Nielsen '92  
Michael W. Patton '94 and  
Lorraine Patton '96  
Timothy D. Paxson '93 and  
A. Morgan Paxson '96  
William R. Pearce '82  
Jennifer K. (Thompson) Pergola '03  
David A. Radtke '87  
Samuel A. Rasmussen '92  
Brian C. Savage '82, MS '90  
Robin L. Schott '96  
Blaine K. Spies '92

Sandra M. Stash '81  
Kathleen D. Steele '89  
Scott L. Stockton '71, MS '76  
James M. Stringfield '98, ME '01  
and Jamie E. Stringfield '98  
James F. Sulzbach '92 and Candace S.  
Sulzbach '81  
Douglas W. Swartz '82  
Kelly T. Taga '00  
William T. Taylor III '84  
David R. Treadwell '84  
Michael L. Troyer '82  
Cecilia K. Tyler MS '87  
Anthony E. Vigil '89, '98  
Barry G. Voigt '91  
Robert N. Wagner '86  
James P. Wakefield '80  
Zhonglin Wang PhD '91  
Jesse D. White '04 and  
Emily L.M. Bostwick-White '04  
Jonathan M. Wilson '06 and  
Caitlin J. Wilson '06  
Robert B. Wilson '86 and  
Erin M. Wilson '85  
Peter J. Wynne '84 and  
Carmen J. Porter '81, MS '93

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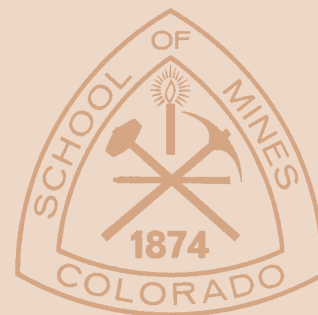
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# Alumni Association Awards 2008

Each year the CSMAA honors individuals who have made extraordinary contributions to the success of the School and the Alumni Association. We are proud to present the 2008 recipients, who received their awards at the Graduation and Alumni Banquet held the evening before Commencement.

**Alumni Teaching Award:  
Professor Neal Sullivan**

Neal Sullivan joined Mines as assistant professor of engineering in 2004. Since joining Mines, Sullivan has taught Fluid Mechanics and Fuel Cell Science and Technology.



He was one of the founding members of the Fuel Cell Science and Technology course, and, according to Engineering Division Director Terry Parker, was “the glue that held the first delivery of this course together.” Sullivan is known by his peers as a professor who has great empathy for his students and determination to help them learn.

**Melville F. Coolbaugh Award:  
Harry Campbell '42**

Harry Campbell '42 was selected for this year's Coolbaugh Award, which recognizes individuals who have made outstanding contributions toward improving the image and enhancing the reputation of the Colorado School of Mines. Campbell's career spanned a



Harry Campbell and family

critical period for the oil and gas industry, during which he was able to make important contributions. Over the years he has made numerous substantial gifts to Mines, making him the sixth largest-ever donor to the School and third among living donors.

**Coolbaugh Senior Awards:  
Jason Bonini, Rebecca Johnson and Timothy Taylor**

By rewarding academic success with need-based financial support for rising seniors, the Coolbaugh Senior Awards reinforce academic excellence.

**Jason Bonini** is earning his degree in civil engineering and is involved with the Minority Engineering Program. He is



the first in his family to attend college. While still learning to balance the intensity of

the Mines curriculum, Bonini was faced with the added challenge of an ailing parent. Rather than buckle under the pressure, he resolved to do whatever it took to make both parents proud. “They are my heroes and my reason to push on. CSM has pushed me to my limits and taught me to work hard to be the

best,” he said. After graduation, Bonini plans to return to CSM and earn his master's degree in civil engineering.

**Rebecca Johnson** is earning her degree in geophysics. A ConocoPhillips SPIRIT Scholar and vice president of the CSM section of the Society of Women Engineers, she also serves as treasurer of the Mines dance team and is a member of the Society of Exploration



Geophysicists. Johnson plans to study abroad next semester at Delft University in the Netherlands.

After graduation, Johnson would like to earn a graduate degree in geophysics or geology, pursuing a career in either seismology or volcanology.

**Tim Taylor** is majoring in materials and metallurgical engineering. Not only an outstanding full-time student, Taylor also holds two part-time positions: one for the US Geological Survey and the other at Northwestern Mutual Financial Network, where he is learning entrepreneurial skills. After his first semester at Mines, Taylor has maintained a GPA above 3.0, and made the Honor

Roll and Dean's List twice. In addition to his busy school and work schedule, Taylor enjoys spending time with his wife, Sarah, and their 18-month-old daughter, Hailey.

**Outstanding Alumnus Award:  
John N. Schwartzberg '88**

John Schwartzberg '88 was honored for his extraordinary and longstanding service to the



Alumni Association, which has included serving as an alumni-admissions representative; a reunion planning

committee member; and an Alumni Association board member, secretary, treasurer, president-elect and president. During his last two years on the board, he was largely responsible for the Joint Operating Agreement, creating better systematic communication, collaboration and collective responsibility between the School and Alumni Association. Kathy Altman, former president of the Alumni Association, says “John recognized the need to make best use of limited resources so that more services could be provided to both alumni and students of the school. John's wisdom and foresight have proven to be infallible. The CSM Alumni Association is progressive, viable and dynamic because of the changes that were made based upon John's foresight, perseverance and commitment to do the best thing for everyone.” Schwartzberg continues to serve Mines in volunteer capacities—during the past few years he served on the Alumni Teaching Award Committee and

on a search committee for *Mines* magazine's editorial board.

Young Alumna Award:  
**Jennifer Van Dinter '97**

Jennifer Van Dinter graduated from Mines with a degree in geological engineering in 1997



and recently earned a master's in finance at the University of Denver. Upon leaving Mines, Jennifer worked as a healthcare and life sciences research analyst at the Robert W. Baird & Company in Milwaukee from 1998 to 2002 and then became director of investor relations and manager of corporate planning

for Young Innovations in Chicago. She was then recruited to work in Denver at Newmont as investment relations manager, and two years later held a similar position at NewWest Gold. Her last stop before graduate school found her serving as an oil and gas equity research associate at BMO Capital Markets. Jennifer recently began PhD studies in the Economics and Business Division at Mines. Jennifer has been a committed volunteer for Mines, serving as an alumni-admissions representative, a Denver Metro section coordinator and a regional director for the Alumni Association Board. Last year, in honor of her 10th Reunion, Jennifer served as class chair for the reunion giving program and as co-chair of the reunion

committee. She has been a member of the President's Council consecutively since 1999.

Alumni Association Honorary Membership Award: **Peter Han**

Peter Han, who currently serves as Mines' chief of staff and senior advisor to the president, was awarded the Alumni Association Honorary Membership Award in recognition of distinguished service to the Colorado School of Mines and the Alumni Association. Prior to his current position, Han served as vice president of advancement, leading the School through a \$135 million fundraising campaign—the largest in its history. Throughout his 15 years at the School, Han has worked with alumni around the globe to create long-lasting



and synergistic relationships. In making this award, the Alumni Association recognizes these past achievements, his continued service to Mines and, in particular, his support and collaboration during a transformational era for the association.

The Alumni Association also granted honorary membership to the May 2008 honorary degree recipients: Daniel Yergin, James Cronin and Mary Wheeler (see page 22 for additional details).



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# Fast Forward

Class Notes  
 Weddings  
 Alumni Profiles  
 Births  
 Passings

## 1952

**James H. Butler III** is managing director for Santana Resources Company in Houston, TX.

## 1957

**Stanley Beitscher** married Ana Maria Chagas of Maringa, PR, Brasil, in August 2005.

## 1961

**Clifford B. Farris** retired in October 2007 and is currently consulting part-time as principal of Clifford Farris and Associates.

## 1964

**Lloyd J. Nordhausen** retired from Frontier Refining Inc. in December 2007 and now lives in Colorado Springs, CO.

## 1967

**Louis B. Harmon** is water and wastewater program manager for Wyoming DEQ/WQD in Cheyenne, WY.

**Kenneth R. Pohle** is senior resource manager for the Trust Land Office in Anchorage, AK.

## 1968

**Steve W. Hackett** is a math and science secondary teacher for Interior Distance Education of Alaska (IDEA) in Soldotna, AK.

## 1970

**Michael R. Barr** is a consulting geophysicist for RPS Energy in Australia and England.

## 1972



**Tom Comi '72, MS '74, MS '75, PhD '88** is photographed here with Jack Hancock and his wife Millie before they toured the Freeport-McMoRan mine in Green Valley, AZ, in February. Tom and his wife live in Tucson with

their two sons. Millie and Jack (an honorary member of CSMAA and a friend of Mines) are based in Golden, CO.

## 1973

**Hamza T. Mabruk** is EGIS National Project Coordinator for EGA - UNDP (Libyan Environment General Authority - United Nations Development Programme) in Tripoli, Libya.

## 1974



**Robert Byrd and Richard LaPrairie** (both Mining '74) meet again in La Paz, Bolivia, after 34 years. Bob is president of Pan American Silver Bolivia and Richard is with LMI Engineering. LMI is subcontracting to

Lyntek (**Buzz Kyle**, also Mining '74) and they are building a 750 TPD flotation concentrator in San Vicente, Bolivia.

**Marc D. Ernest** is regional operations manager for Plains Exploration & Production Company in Houston, TX.

## 1975

**Michael G. Leidich** is vice president of LYNX E&M LLC in Golden, CO.

**William A. Warfield** is product manager of ground engineering products for Atlas Copco Drilling Services in Roseville, CA.

## 1978

**Kevin D. Jones** was re-elected president of the Professional Land Surveyors of Wyoming through February 2009.

**Richard D. Nichols** has joined the Colorado/Wyoming leadership team of Short Elliott Hendrickson Inc. (SEH), a professional consulting services firm, as the new western region land development leader. In his role at SEH, he will oversee land development and planning projects.

**Mark H. Wood** is operations service manager—Ahafo for Newmont Ghana Gold Limited.

## 1979

**H. Thomas Bowles** relocated to Denver in 2005. He completed rotational work in BP's Azerbaijan Republic in March 2008. Currently Thomas is rotating to BP Exploration Operating Company Ltd, Ho Chi Minh City, Vietnam.

**Alan J. Mencin** is senior vice president of energy, renewable energy technology and environmental services for Catalyst Ventures, Inc. in Golden, CO.

**Mohammad N. Salleh** is retired and living in Shah Alam, Selangor, Malaysia.



*The 2008  
Spring Golf  
Tournaments  
were an  
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success.  
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next year!*

# The Colorado School of Mines Alumni Golf Tournaments

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Ken Nickerson  
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Cross D Bar Trout Ranch  
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Capital Gold Corporation

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## 1980

**Patrick D. Allen** is a technology consultant for General Dynamics UK Ltd. in St. Leonards-on-Sea, East Sussex, UK.

**Theodore R. DePooter** is an associate for Jacobs Associates in Kennesaw, GA. He is starting the South Cobb Tunnel Project, a six-year, six-mile, 27-foot-diameter tunnel in the Atlanta area.

**Philip O. Johnson** is a senior engineer and project manager for New Tech Engineering in Denver, CO.

**Phyllis Fett Halvorson Porter** is serving as the president of the Association for Women Geoscientists Foundation from fall 2007 to

fall 2009. She and her husband, Barry Porter, live in the Santa Cruz Mountains on the California coast. Phyllis has been substitute teaching in local schools for several years, as well as staying active in AWG and AWGF.

## 1981

**James J. Emme** is president of Source Exploration LLC in Denver, CO.

**John Y. Jo** recently joined Dynamic Offshore Resources, LLC, in Houston, TX, as senior vice president. Previously, he was president and chief operating officer for Turnkey E&P Corporation, also located in Houston.

**Alfred E. Keller** is a sulfur processing leader for Conoco Phillips Downstream Refining in Ponca City, OK. Alfred has recently been granted his 18th and 19th U.S. Patent.

**James P. McCalpin** continues to consult on geologic hazards and abatement worldwide ([www.geohaz.com](http://www.geohaz.com)). Current projects include a ski area in Colorado, active faults and a proposed reservoir in Utah, electrical substations and LNG terminal in South Africa, and more. "With all the new infrastructure projects," writes James, "there is a lot of work for crafty old engineering geologists. Stop by in Crestone, where you can buy magic crystals and New Age everything."

**Mark T. Winter** is a geophysical advisor for ENI Petroleum in New Orleans, LA.

# Profile

## A Living Peace



World War II pilot **James (Pete) Mullinax** '47 had just finished bombing a ball-bearing factory in Schweinfurt, Germany, on October 14, 1943, when he and his crew of nine had to bail out of their stricken B-17 Flying Fortress. The plane had survived the onslaught from German fighters on their way to their target, as well as the anti-aircraft fire. But after an engine was hit on their return journey they started falling behind the squadron. "We became a 'straggler'... and we knew we were a sitting duck," writes Mullinax in his book, *Foes by Fate... Friends by Choice*.

Pete escaped death by a whisker in the withering attack that ensued: "The exploding bullets hit my seat, injuring my left arm, my side and my leg." After another engine was hit and the right wing caught fire, he gave the order to bail out. He passed out from oxygen deprivation immediately after pulling his ripcord and eventually came to rest dangling between two fruit trees a few feet from the ground just outside the town of Osterburken.

When he raised his arms to grab the parachute lines above him, he slipped to the ground. "I hadn't secured my leg straps. I could have easily fallen 15,000 feet to my death," he says. After being taken to a hospital for treatment, he went on to prison camp where he was reunited with members of his crew—he was there until the end of the war, a total of 19 months.

In 1998, 55 years later, Pete was invited to return to Shweinfurt to participate in a dedication ceremony for a memorial to the hundreds of citizens and airmen from both sides who lost their lives during the October 14 strike. After this moving and emotional occasion, Pete returned to the US with some poignant memories, new friendships and a resolution to return to the area.



James (Pete) Mullinax (front row third from left) with the crew of his B-17

When he travelled to Shweinfurt again three years later for the annual memorial service, he came with more time on his hands. He wanted to explore the area, and he wanted to visit the town he had parachuted into—Osterburken. Travelling just one month after September 11, 2001, he had a particularly warm reception. The mayor arranged for him to visit the exact spot where he dropped from his parachute and to meet the man who picked him up off the ground after the fall. He also met the nurse who cared for him in the hospital and two women who saw him parachute that day. "I guess they were about 11 years old at the time," Pete says. "Everyone was so friendly and happy to meet me. It was an amazing and tremendous visit," says Pete, who now lives in Conroe, TX and recently turned 92.

Reflecting on his experiences in Germany, Pete is philosophical: "It is such a satisfying feeling that I have experienced—a living peace among my former adversaries, who clasp my hands in true friendship."

Mullinax's book *Foes by Fate... Friends by Choice* is available by calling (936) 856-2482.



# Weddings



**Marty Jertson '02** was married to Kellyn Newman on April 1, 2008. Alumni present were (left to right) **Lisa Gonzales '98**, **Wes Reynolds '02 MS '04**, Kellyn, Marty, **Jack Sayers '02**, MS '03 and **Lindsay Sayers '02**.



**James Page '03** and **Jessica Smagala '07** were married on December 29, 2007 at the Rockland Community Church in Genesee, CO. Twenty-three Mines graduates were in attendance!



**Leslie Pagels '79** married Wayne Penello on December 8, 2007 at a home ceremony at their ranch in Round Top, TX.



**Jennifer L. Seder '04** married Benjamin Schenkman on July 21, 2006. Mines Alumni attending included **Jessica Miller '05**, **Sarah Wilson '05**, **Lauri Stankewicz '05** and **Joe Gross '05**.



**Katherine Muterspaugh '07** and **Daniel Steele '07** were married August 6, 2007 in Colorado Springs, CO. Groomsmen and bridesmaids included **Bryan Carruthers '07**, **Casey Ramey '07**, **Sarah Rickard '07** and **Lindsey Quinlisk '07**. Other Mines alumni were among family and friends in attendance.



**William T. Parker '01**, MS '03 married Sara Ripperger on February 23, 2008 in Indianola, IA. In attendance were Mines alumni **John Renz '01** and **Corey Scheele '01**.

## 1982

**David A. Ostrander** is program director of emergency response for the U.S. Environmental Protection Agency in Denver, CO.

**Michael J. Ryan** is a mining engineer for Independent Mining Consultants in Tucson, AZ.

**Saad T. Saleh** is a consultant for Drill-Sense International in Centennial, CO.

## 1983

**Jeffery H. Altman** is vice president of U.S. sales and operations for Control Microsystems in Denver, CO.

**Scott M. Brown** is vice president and senior program manager for Arcadis G&M Inc. in Phoenix, AZ.

**Todd R. Habliston** is asset manager for Warren Resources in Long Beach, CA.

## 1984

**Kevin N. Brown, P.E.** is chief mine engineer—open pit—Hope Bay, for Newmont Gold Co. in Englewood, CO.

**Gary D. Harris** is a geophysical advisor for the Hess Corporation in Houston, TX.

**Thanh D. Le** is country chairman for Shell Vietnam in Ho Chi Minh City, Vietnam.

**Bruce L. Niemeyer** is general manager, strategy and planning, for Chevron North America Exploration and Production, based in Houston, TX.

**Jeffrey K. Warmann** is director of strategic planning and business development for Frontier Refining & Marketing Inc. in Denver, CO.

## 1985

**Lisa M. Horswill** is a staff systems analyst for Sorin Group USA, Inc. in Arvada, CO.

**Clayton S. Pluchek** is vice president of engineering for Ferro-Tube Oil Tools in Spring, TX.

**Michael J. Rosenberg** is vice president of business development for the U.S. for Evergreen Energy, Inc. in Denver, CO.

**Deborah J. Shields** has retired from the USDA Forest Service and now works as a researcher in mineral economics in the Department of Economics at Colorado State University in Fort Collins, CO.

**Pedro P. Vera** is a field engineer for LynTek, Inc. in Lakewood, CO.

## 1986

**Gregory E. McIntosh** is an operations manager for Anadarko Petroleum Corporation in Evans, CO.

**Eric J. Phannenstiel** writes that he is "one of the founders of a software company based in Vail, CO, called Resort Technology Partners. We write software and design web sites for clients in the resort and recreation industry. We are 85 people strong, and proof that you can have a high tech company anywhere you want to!"

**Don L. Wilkerson** is space operations officer for the U.S. Army in Carlisle, PA.

## 1987

**Gordon L. Fellows** is technical service manager for Chelopech Mining EAD in Chelopech, Bulgaria.

**Steven B. Hinchman** has been named executive vice president of technology and services for Marathon Oil Company in Houston, TX. He has responsibility for health, environment and safety; upstream technology; emerging technology; major projects; corporate social responsibility; and commercial services.

## 1988

**Angelina M. Dennis** is an engineering project manager for Wind River Systems in Alameda, CA.

**Andrea J. Gallagher** is a program manager for Photon Research Associates, Inc. in Albuquerque, NM.

**Jeffrey W. Jackson** is manager of global seismic infrastructure renewal for Shell Oil Company in Houston, TX.

**Nicholas W. Riggio** is vice president and general manager for Logical Systems Inc. in Golden, CO.

**Brian C. Tripp** is an associate professor in the Biological Sciences Department for Western Michigan University in Kalamazoo, MI.

**Dennis M. Vidmar** is manager: safety, health and environment for ExxonMobil Environmental Services in Fairfax, VA.

## 1989

**Craig Friesen** is executive vice president for BSF Inc. in Littleton, CO.



**Paul Kyed** recently joined the law firm Holland and Hart as a member of the commercial litigation group after completing a one-year clerkship with Justice Nathan B. Coats of the Colorado Supreme Court. Paul received his JD in '06, Order of St.

Ives from the University of Denver, Sturm College of Law

**Marc Thomas** is owner and general director of Industrial Solutions and Technologies in Moscow, Russia.

**Vincent J. Wegher** is an attorney for the Husted Law Firm in Denver, CO.



**Michael J. Young** is a foreign service officer for the U.S. State Department in Arlington, VA. In July, he

will head to Toronto as vice consul at the U.S. Consulate for the next two years with his wife, Lindsey Rankin, and their daughter, Lily. This photo was taken on the day Michael learned of his posting.

## 1990

**Russell L. Croley** is regional technology manager for Halliburton in Dubai, United Arab Emirates.

**Katerina Dimou** is an independent engineering consultant in Columbus, OH.

**Michelle A. Ehlers-Peterson** is a process engineer for Range Fuels in Broomfield, CO.

**Theron W. Jensen** is a project manager for Alliance Engineering in Denver, CO.

**Christopher L. Wright** is a project manager for MTB Project Management Professionals, Inc. in Greenwood Village, CO.

## 1991

**Esa I. Kivineva** is chief information officer for Wartsila Corporation in Helsinki, Finland.

**Barry A. Thomas** completed his master of divinity degree at Bethel University in 2007. He is an associate minister for Golf Course Road Church of Christ in Midland, TX.

**Barry G. Voigt** is a reservoir engineer for Cirque Resources LP in Denver, CO.

## 1992

**Zaal Anuar Alias** is a senior reservoir engineer for Netherlandse Aardolie Maatschappij BV in Assen, Netherlands.

**Hans C. Hoppe PMP** is program manager for Rockwell Collins Corporation in Cedar Rapids, IA.

**Andrew I. Hustrulid** is business development manager of the materials handling service for Sandvik Mining and Construction in Bayswater, Western Australia.

**Penny J. Pettigrew** is now the Ares I First Stage Systems Engineering and Integration Team engineering lead at NASA's Marshall Space Flight Center. She serves as a senior engineer within the Spacecraft and Vehicle Systems Department responsible for coordinating system verification across the engineering directorate. Her primary task is to direct inter-element and interdisciplinary studies and analyses to assure that the Ares I launch vehicle performs according to its requirements. She is responsible for defining, developing, and evaluating Ares I flight systems with the corresponding ground support equipment in support of NASA's Constellation Program.

**Syed Zaifur Hamzah Syed Abdul Hamid** is general manager and principal consultant for Risktec in Kuala Lumpur, Malaysia.

**Broc R. Thompson** is a channel sales representative for Silicon Graphics Inc. in Sunnyvale, CA.

**Timothy R. Yearous** is complex manager for Valero in Texas City, TX.

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# Profile

## Alumna Elected President of Engineering Council



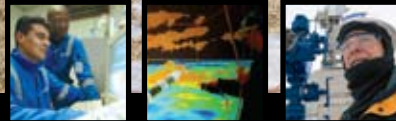
The American Council of Engineering Companies of Colorado (ACEC/CO) recently elected **Lauren E. Evans** '82 president of the board, marking the first time a woman has held this office. The 52-year old organization has 250 member firms that employ more than 10,000 individuals in the private practice of consulting engineering. Lauren is also president of the company she founded, Pinyon Environmental Engineering Resources.

Lauren came to Mines from the East Coast in the late 70s, drawn by a desire to study geology and engineering. After receiving her bachelor's degree in geological engineering, she began her career with the USGS, subsequently moving on to work for several private engineering firms. Her work focused on environmental engineering and she took on a wide range of projects, including Yucca Mountain, Superfund sites, mapping permafrost in Alaska and saltwater intrusion in California. In 1993, she founded Pinyon Environmental Engineering Resources, which now employs a staff of 25 and is headquartered in Lakewood, with a branch office in Saratoga Springs, NY.

In 2005, Lauren was recognized with ACEC/CO's Outstanding Woman in Engineering Award, which recognizes exceptional technical competence, community involvement and leadership skills. She was also honored when former Colorado Gov. Bill Owens appointed her to the Colorado Hazardous Waste Commission, where she served as committee chair from 2004 until 2007.

When Lauren isn't solving problems as an engineer, she is active in her community, exercising her passion for the environment and social welfare. She serves on the board of directors of the nonprofit organization Socially Conscious Coffee, a Denver-based group that addresses the educational needs of the children of coffee workers in Brazil—this fall she will travel there to promote their endeavors. She has also served as a court appointed special advocate, representing abused and neglected children.

Lauren is quick to share how rewarding her career as an engineer has been, and she enjoys the opportunity to raise public awareness, understanding and appreciation of the engineering profession. In particular, she is committed to cultivating the next generation of engineers: "We know that there are concerns about shortages of engineers in the future and as a profession we need to make a concerted effort to ensure that students are aware of the interesting and challenging opportunities this career path offers. After all, our quality of life—health, safety and public welfare—depend on this critical workforce," she says.



*"My career has been everything they said it would be...and much more."*

*Nalita, Field Engineer*

"From the beginning my recruiter gave me a very good idea of what to expect from the field engineer job: the challenges of working in the field, the training and mostly, about all the opportunities Schlumberger can offer if you're ambitious and ready to work hard. I admit that I expected some resistance as a woman in a traditionally male dominated industry. But from my first day I was treated as an equal. I went through intense training – industry-leading training. And when I reached my first assignment in the oilfield, I was more than ready. Now I have my entire career to look forward to. I might stay in the field. I might move into management. At Schlumberger, it's up to me."

*As a field engineer, Nalita and her crew work at the client wellsite performing services that will improve the knowledge and performance of the reservoir. Nalita holds a BS in Electrical Engineering from Colorado School of Mines.*

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## 1993

**Darrell H. Eldridge** is a graduate student at the Colorado School of Mines.

**Andres S. Escalante** is a PC technician and consultant for Escalante PC Technicians in Metairie, LA.

**Jeffrey E. Gilmore** is senior manager of engineering for Amgen Inc. in Longmont, CO.

**Christopher M. Houglund** works in supplier development for Applied Materials in Austin, TX.

## 1994

**Yohan Kusumanegara** is an exploration geologist for Hess Limited in London, United Kingdom.

**Rebecca L. Wall** is a senior project engineer/team lead for Navarro Research and Engineering in Lakewood, CO.

## 1995

**Barry J. Gaston, Jr.** is an account representative for Sperry Drilling Services for Halliburton in Denver, CO.

**Ginger L. Hustrulid** is a solutions engineer for Sandvik Mining and Construction in Bayswater, Western Australia. She is also the owner of Hustrulid Technologies.

## 1996

**Jami L. Alley** provides technical support for Adventure Central in Denver, CO.

**Jonathan M. Bloomfield** completed his master's degree in finance at the University of Colorado in 2007. He is manager of financial planning for Teton Energy Corporation in Denver, CO.

**Jonathan S. Keller** is a student at the U.S. Army War College at Fort Monmouth, NJ.

**Mary A. Ortiz** is IT project manager for the Department of Health & Environment in Denver, CO.

**C. Jason Pinto** is a senior drilling and completion engineer for Roc Oil (Bohai) Company in Beijing, China.

## 1997

**Mohammed M. Al-Bustan** is a specialist of marine transportation for Kuwait Petroleum Corporation in Safat, Kuwait.

**Kriss B. Bergethon** is chief executive officer and founder of Green-Way Builders, LLC in Steamboat Springs, CO.

**Erik A. Close** is uplink supervisor for Comcast in Littleton, CO.

**Mikyong (Mikki) Hand '91, MS '97** (see Class of 2029) is still practicing full spectrum family medicine with obstetrics at Salud Family Health Center in Longmont, CO.

**Grady M. O'Brien** is a senior water resources engineer for Tetra Tech, Inc. in Fort Collins, CO.

**Michael E. Stahl** is production and operations manager in the Uinta Basin Division for Questar Exploration & Production in Denver, CO.



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# Class of 2029



**Andy '06** and **Amanda Bell** announce the arrival of their baby girl, **Heather Erin**, born on April 16, 2007.



**Dayven '02** and **Chelsea Johnston** welcomed their son, **Wyatt**, born on August 31, 2006 in Nashville, TN.



**Vincent J. Wegher '89** and his wife **Heather** announce the birth of their first child, **Lane Addison**, on March 9, 2008, in Denver, CO.



**Mikyong (Mikki) Hand '91**, MS '97 and her husband **Paul Searcy** welcomed their daughter **Helen Patricia Searcy** on September 10, 2007.



**Boris '03** and **Kate '02 Kalikstein** recently welcomed **Chase Landon** on September 25, 2007.



**Luis '06** and **Alyce Martinez** welcomed the new addition to their family, **Ava Kate**, born on September 28, 2007.



**Jennifer Seder '04** and **Benjamin Schenkman** announce the birth of their son **Joshua Logan Schenkman** on December 7, 2006.



**Craig '06** and **Cherie VanHorn** announce the arrival of their daughter, **Iylah Rose**, born May 19, 2007.



**Brandon '02** and **Amy '03 Schrenk**, along with big sister **Allison**, celebrate the arrival of their second daughter **Jordan Mikayla**, born on May 14, 2008.

**Stephen James Turner** is chief geologist for Newmont Asia Pacific of Newmont Mining Corporation in Subiaco, Western Australia.

## 1998

**Joseph A. Dodds** is a quality assurance engineer for Lockheed Martin Corporation in CO.

**Jordan C. Hixson** is subsurface manager for Anadarko Petroleum Corporation in Denver, CO.

**Kevin J. Kidd** is regional construction manager for Bechtel International in Montreal, QC, Canada.

**Bryan K. Luke** is a lieutenant colonel for the U.S. Army in Fort Riley, KS.

**Summer B. Montgomery** is a graduate student in the physics department at the Colorado School of Mines.

**Patrick D. Sandoval** is director of hydrocarbons for WorleyParsons Engineering Egypt Limited in Maadi-Cairo, Egypt.

**Lisa Kerschner Schvien** is a project engineer for Kennedy/Jenks Consultants in Lakewood, CO.

**Anthony E. Vigil** is production unit manager for Shell Oil Company in Geismar, LA.

**Frederick S. Wegert** is a senior design engineer for Gamba & Associates, Inc. in Glenwood Springs, CO.

## 1999

**Jesse D. Chuhta** moved from Boeing Satellite Systems (El Segundo, CA) to Lockheed Martin Space Systems (Lakewood, CO), where he works as a senior mechanical engineer. He is also the recipient of the 2008 AIAA Young Engineer of the Year award for the Rocky Mountain region.

**Jason LeGore** is a mechanical engineer responsible for improvements to the mechanical design of products and improvements to the engineering department for UWATEC, a small Swiss company.

**Joshua S. Lewis** is contracts manager for Patterson-UTI Drilling in Denver, CO.

**Andrew L. Olson** is a graduate student at the Colorado School of Mines pursuing his master's in engineering and technology management.

He is also a captain and company commander of the 4th Engineer Battalion for the U.S. Army.

**R. Kevin Thompson** is a senior account manager for Baker Hughes Drilling Fluids in Denver, CO.

**A. Anibal Troconis** is a senior process engineer for Shaw Stone & Webster in Toronto, ON, Canada.

## 2000

**Magdalena A. von Haas Boogaard** is a project manager for Robert Bosch LLC. She lives in West Bloomfield, MI.

**W. Paul Francis** is a process engineer at the Gary Works for United States Steel in Gary, IN.

**Tiani Jones** is lead localization engineer for Lionbridge Technologies in Boulder, CO.

**Shinsuke Murakami** is a lecturer in the Department of Systems Innovation in the Graduate School of Engineering at the University of Tokyo in Bunkyo-ku, Tokyo, Japan.

**Jeffrey W. Pinkal** is director of technology for Epsilon in Lafayette, CO.

**Zan E. Svendsen** is vice president of engineering for PDC Logic in Denver, CO.

**Anthony L. Vessa, Sr.** is a senior process engineer for Freescale Semiconductors in Tempe, AZ.

**Mahesh Vidyasagar** is a project manager for ExxonMobil Environmental Services in Houston, TX.

## 2001

**Brianna G. Atherton** is a process engineer IV for Washington Group International, Inc. in Denver, CO.

**Sean A. Dickey** is customer satisfaction manager for InterDyn Business Microvar in Roseville, MN.

**Roger A. Furley** is a production geologist for BP Alaska in Anchorage, AK.

**Holly D. Hindle** is a production engineer for Production Services Network in Wamsutter, WY.

**Jake and Emily (Troxell) McGahee** announce the birth of their son, Mitchell Andrew McGahee on March 29, 2008. He joins his brother Joseph, 2, at their home in Church View, VA. Their email address is epmcgahee@gmail.com.

**William T. Parker** is an associate for Booz, Allen & Hamilton in Huntsville, AL.

**Michael T. Seman** is VP of research and development for SiC Systems in Golden, CO.

**Angelina C. Southcott** is a geophysicist for Rosetta Resources in Denver, CO.

## 2002

**Travis N. Attanasio** is an associate for A.N.A. Consultants LLC in Fort Worth, TX.

**John-Paul DeBauge** is a project engineer for Belmor Inc. in Chicago, IL.

**Eric Dillenbeck** is a senior geologist for BHPB Petroleum in Houston, TX.

**Marty Jertson** (see Weddings) lives in Cave Creek, AZ, with his wife, Kellyn. He works for PING as a Senior Design Engineer for PING Golf.

**Barry E. Miller** is president of Foresight Advantage in Littleton, CO.

**Zachary T. Miller** is a process engineer for Merrick & Company in Aurora, CO.

**Anthony M. Phillips** is an architect for Patricia Brennan Architects in Seattle, WA.

## 2003

**Donald I. Althouse** is a mechanical design engineer for Roeslein in Northglenn, CO.

**Birgit Braun** is a graduate assistant in the chemical engineering department at the Colorado School of Mines.

**Bernadette M. DeCianne Jones** is a consultant for Accenture in Denver, CO.

**Robert Charles Jones** is a production engineer for Coors Tek, Inc. in Golden, CO.

**Alyssa A. Kohlman** is a geological engineer for Tetra Tech in Golden, CO.

**Mathieu C. Le Renard** is a consultant for the Boston Consulting Group in Paris, France.

**Nathan J. Lewis** is a research and design engineer for Omnitech International, Inc. in Denver, CO.

**Joe Mazumdar** is director of corporate development for Newmont Mining Corporation in Denver, CO.

**Ramon Mendoza** is a mining engineer for AMEC Americas Ltd. in Vancouver, BC, Canada.

**Jared G. Noe** is an IT2 on the USS *Bunker Hill*, a Ticonderoga class guided missile cruiser.

**Matthew J. Oliver** is a sales engineer for Haynes Mechanical Systems in Greenwood Village, CO.

**Samuel Quainoo** is a reservoir engineer for ConocoPhillips in Midland, TX.

**David A. Renner** is a wireline engineer for Halliburton in Grand Junction, CO.

**Adam K. Smith** is a senior sales and support engineer for Alpha Data. He lives in Alexandria, VA.

**Timothy S. Sorensen** is a user support engineer for ExxonMobil Corporation in Houston, TX.

## 2004

**Matthew K. Boyd** is manager of logistics and installations for iCrete in Beverly Hills, CA.

**Stephen B. Busch** is a research assistant for the Institute for Reciprocating Engines, University of Karlsruhe in Karlsruhe, Germany.

**Zeke D. Coleman** is a project engineer for Adams Engineering in Carlsbad, CA.

**J. Weston Davis** is a process engineer for Water Remediation Technology in Wheat Ridge, CO.

## 2005

**Andrea C. Fleming** is an engineer for TZA Water Engineers Inc. in Lakewood, CO.

**Matthew J. Hazleton** is a compliance engineer for TRC Consulting in Littleton, CO.

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**Naomi E. Ott** is a process engineer for Motiva Enterprises, LLC in Port Arthur, TX.

**Nicole M. Pendrigh** is a geophysicist for Zonge Engineering and Research Organization, Inc. in Tucson, AZ.

## 2006

**Matthew L. Adkins** is a senior consultant for Science Applications International Corporation in Houston, TX.

**Andrew D. Bell** is a mechanical engineer for Dynamic Air Inc. in St. Paul, MN.

**Sarah A. Cisper** is a project manager for Burns & McDonnell in Fayetteville, NC.

**Daniel L. Cortez** is a medical student at the University of Illinois, College of Medicine at Rockford.

**Piper L. Howell** is a technical advisor for UOP / Honeywell in Des Plaines, IL.

**Erik C. Jones** is an engineer in training for Suncor Energy Inc. in Ft. McMurray, AB, Canada.

**Zachary J. Kimball** is an environmental consultant for Cordilleran Compliance Services, Inc. (Cordilleran) in Arvada, CO.

**Matthew E. Mientka** is a production engineer for BP in Houston, TX.

**Jacob W. Richardson** is a process engineer for Jacobs Engineering in Golden, CO.

## 2007

**Michael A. Brandt** is an associate technical professional for Halliburton Energy Services in Grand Junction, CO.

**Tyler N. Elliott** is an engineer I for the Anadarko Petroleum Corporation.

**Daniel M. Frary** is a project leader for Exxon-Mobil in Torrance, CA.

**Erin R. Griggs** is a software engineer for Lockheed Martin Corporation in Littleton, CO.

**Jeffrey M. Hammer** is a project engineer for Brierley Associates LLC in Littleton, CO.

**Robert Edward Keith** is a senior scientist for ITT Industries, Inc. He lives in Colorado Springs, CO.

**Ulrich K. Koberg** is an international mobile field engineer for Schlumberger Drilling and Measurements in West Africa.

**Benjamin D. Kreutzberg** is a graduate student in law in the Sandra Day O'Connor College of Law at Arizona State University in Tempe, AZ.

**Ronald Jason Livesay** is a R&D associate for UT-Battelle (Oak Ridge National Laboratory) in Oak Ridge, TN.

**Loan K. Luong** is a graduate student at the Colorado School of Mines.

**Christopher S. Marafine** is a graduate student at the Colorado School of Mines.

**Sarah A. McDonald** is a process engineer for Dow Chemical Company in Midland, TX.

**Flavio Medeiros Junior** is a senior petroleum engineer for Petrobras/UN-RNCE in Natal-RN, Brazil.

**David A. Murrell** is a graduate student at the Colorado School of Mines.

**Reginald E. Onyirioha** is an earth scientist for Chevron Nigeria Ltd. in Lagos, Nigeria.

**Adam B. Prochaska** is a geotechnical engineer for RJH Consultants in Englewood, CO.

**Steven W. Schow** is a quality engineer for Unicircuit, Inc. in Littleton, CO.

**Ayoub K. Semaan** is a junior associate for McKinsey & Company, a management consulting firm, in Dubai, United Arab Emirates.

**Daniel K. Steele** is a chemical engineer for SRI International in CA.

**Sarah M. Stokes** is a process engineer for Shell Oil Products US at the Shell Puget Sound Refinery in Anacortes, WA.

**Nikolas A. Sunde** is a graduate student at the Colorado School of Mines.

**Bryan K. White** is an engineer I in the Washington division for the URS Corporation in Denver, CO.

# Passings

To live in hearts we leave behind  
Is not to die.

—Thomas Campbell 1777-1844



**WAYNE P. BOTT** '86 of Huntington Beach, CA died on February 12, 2008. Born in 1963, he grew up in Arvada, attending Arvada High School where he played football. After graduating from Mines with degrees in math and chemical engineering, he went on to work for Mangan, Inc. Friends and coworkers remember him as charismatic, yet down-to-earth. He and his wife, Sharlot, were competitive swing dancers, at one point taking six years out from their careers to tour, teach and compete in national competitions. Athletic throughout his life, he organized company volleyball and wallyball games among his colleagues during his 15 years with the company. A self-described geek, he was respected by his colleagues as one of the most talented control systems engineers in the industry. They also respected him for the adventurous life-course he and his wife charted together. He is survived by his wife, Sharlot; his parents, John and Dixie Bott; his sisters, Lori Brown and Lana Mayns; and his grandmother, Minnie Ginther.

**MICHAEL T. BREZINA** '80 of Houston, TX died on December 5, 2005. After earning his degree in chemical engineering from Mines, he spent four years in Germany as a captain in the U.S. Army. He later went to Boston University to earn his MBA. During his years living in Baton Rouge, he volunteered for numerous charities. At the time of his death, he was a project engineer with ExxonMobil and a vice-chairperson of the company's corporate volunteer council. He is survived by his parents, Gerald and Karen; his two daughters, Tara and Alexy; his brother, Steve; and his sister, Camille Scheuer.



**GLEN D. CHENEY** '58 passed away on November 13, 2007, in Delta, CO. Before coming to Mines to earn his degree in petroleum engineering, he served in active duty in Korea with the U.S. Army. While attending Mines he met Marjorie Browne Simpson, whom he married in 1956. At Mines he formed a flying club, helping to raise \$500 to buy a 1946 Piper Cub—flying was a lifelong passion from then on. His career included working for the USGS in Santa Fe, NM, and Sinclair Gas & Oil in Wyoming. During the sixties, he spent two years working in West Pakistan as a project engineer for Tipton and Kalmbach. He also worked on the Titan 1 Missile Program in Colorado and Washington State. In addition to flying, he enjoyed fishing, hunting and skiing. He owned and operated Delta Air Service, Inc. out of Delta, CO for

12 years, beginning in the mid-eighties. In 1996, he purchased a hangar home in Salome, AZ so he could continue to fly during his retirement. Glen is survived by his wife of 52 years, Marjorie; his son, Steven; his daughters, Lisa Tourney and Alison Thomas; his brother, Eldon; his sisters, Charlotte Thompson and Helen Beagh; seven grandchildren; and two great-grandchildren.



**ROBERT P. COMSTOCK** '41 of Ocean Springs, MS died on May 3, 2008. After graduating from Mines with a bachelor's degree in mining engineering, he served aboard the *U.S.S. Curtis* during World War II. Described as "Always a gentleman and always a gentle man," he was an active member of the Masonic Lodge of Kettle Falls, IA, and a past president of the Colorado Mining Association. Although he lived in Denver for much of his career, he traveled extensively for his work with Ideal Basic. He retired in 1992 and moved to Mississippi, where he became very involved with the local golf community of St. Andrews. In addition, he enjoyed bridge and attended many social events. He was predeceased by his beloved wife of 65 years, Mary. He is survived by his daughter, Corinne Comstock and her husband, Robert Halvorsen.



**JAMES W. DITTO** '95 died March 19, 2007. Born in Chillicothe, OH, he enlisted in the U.S. Air Force in 1965, his tour of duty taking him to Vietnam. After moving to Denver and attending CU for a time, he began working for Coors Brewing Company, where he obtained seven patents for the company. While still an engineer at Coors, he attended Mines. After earning his degree in electrical engineering, he pursued several entrepreneurial projects. He received two more patents, and taught himself multiple programming languages so that he could complete a math learning program for students K-6. Jim's many interests included hunting, biking, walking, ice fishing, basketball and camping. He also loved astronomy, and would lead tours and present evening programs at the DU Observatory. He will be remembered for many qualities, in particular for how he channeled his vast intelligence and inventiveness for the benefit of others. Jim is survived by his dear friend Beverly Earley; his son, Michael; daughter, Holly; brother, Charles; and numerous stepsiblings. He was predeceased by his wife, Elisa Notarianni.





**JOSEPH L. FUSSELMAN** '42 died on February 15, 2008 in Centennial, CO. Born in Oklahoma in 1919, he graduated first from the Oklahoma Military Academy and then later earned his degree in petroleum engineering from Mines. While at Mines he lettered in hockey, and, more importantly met his wife, Jean Burdette; they were married prior to his graduation in 1942.

Serving with the rank of major, he spent four years with the Army in Alaska during World War II setting up temporary landing strips for Allied forces operating in the Pacific. After the war, his career in the oil industry included working for Amerado Petroleum, Texaco Oil, Trigood Oil, Great Plains Oil and his own company, Minerals Management, Inc. He and Jean moved from Louisiana to Cody, WY, before settling in Casper to raise their family. In the early seventies, they returned to Denver before he retired in 1977. He enjoyed horses, cattle, fishing, pheasant hunting, golf, football and traveling with his wife. He is survived by his wife Jean; sons Van, Fred, and Jim; daughter, Luanne Nilsson; seven grandchildren; and nine great-grandchildren.



**RALPH L. HENNEBACH** '41 passed away on March 6, 2008. He was born in Garfield, UT, but grew up in Leadville, CO, where his father was superintendent of the Leadville Smelter and Refinery. He earned his degree in metallurgical engineering from Mines and an MBA from MIT in 1953. He served as a lieutenant in the U.S. Navy during World War II. After the war, he returned

to Denver to marry his sweetheart, Mary Lou Johnston. While still in high school, Ralph had begun his career at ASARCO with a job as carpenter's assistant; he returned after the war, and ultimately became CEO and chairman of the company before retiring in 1985. He served as a director of many boards and was a great supporter of Mines, creating a large endowment that supports the Hennebach Lecture Series, designed to stimulate interest in the humanities among faculty and students. He and his wife of 61 years raised their family in Short Hills, NJ and enjoyed playing golf and traveling. Ralph is survived by his wife, Mary Lou; his son, Mark; his daughters, Anne Kirspel and Margo Hennebach; his sister, Carmen Fisher; and six grandchildren.



**CARL L. HILTROP** prof. '60—'82 passed away on December 18, 2007. He was born in Farmington, IL in 1922. Shortly after graduating from high school—the first person in his family to do so—he joined the U.S. Navy and served as a flight engineer primarily on B-24 bombers.

After the war, he went on to attend Bradley University in Peoria, and then Iowa State University in Ames, where he completed PhDs in both chemistry and geology. In 1960 he joined Mines' Department of Chemistry and Geochemistry.

A dynamic teacher, students acknowledged his dedication with several teaching awards and honorary memberships to student clubs and societies. He was the faculty sponsor of the soccer team, a timer for varsity wrestling, a referee for Engineer's Day events and a regular participant in the annual Orecart Push to the capitol. A skilled marksman and hunter, he loved the outdoors, visiting Alaska every summer for many years. After retiring in 1982, he moved first to Nampa, ID, then to Washington State. Carl is survived by his wife, Claudia. He was predeceased by his parents and siblings.



**JAMES C. HOLLINGSWORTH** MS '53 of Shreveport, LA died on September 26, 2007. Serving in the U.S. Army from 1943 to 1946 in radio intelligence, he landed on the beaches of Normandy on D-Day and was later awarded the Bronze Star Medal. After the war, he returned to Shreveport, LA, where he attended Centenary College, earning a bachelor's degree in geology,

graduating magna cum laude and gaining admission to the honor fraternity, Omicron Delta Kappa. He later attended Mines where he earned his master's degree in geophysics. After graduating from Mines, he embarked on a long career in the energy industry, working for Colorado Exploration Co., Phillips Petroleum, Nilo Oil and Tensas Delta Land Company. More recently, operating as an independent consulting geologist from his home town of Shreveport, LA, he worked with numerous clients throughout Texas, Mississippi, Louisiana and Arkansas. Blessed with a long and successful career, he will be remembered for his love for family, faith in God, loyalty to friends and service to his country. He was predeceased by his wife of 27 years, Marian Pardue. He is survived by his daughters Marian Keator and Robin LaBorde; his son, James C. Hollingsworth Jr.; five grandchildren; and six great grandchildren.



**JESUS L. JALANDONI** '40 of Manila, Philippines died on September 25, 2007. Jess was born in Iloilo City in the Philippines, the second of 12 children. He began his college studies at the University of the Philippines before transferring to Mines, where he earned an engineer of mines degree. After graduation, he returned to the Philippines and served in the guerrilla forces until the country was liberated in 1945. Less

than a year later, he married Angeles Locsin Soriano. He produced sugar cane during his early career, and he was vital to the formation of a planters association in his area. He moved to Manila in 1959, where he ventured into real estate, flour milling, appliance manufacturing, banking, and insurance. He was a director of many companies, as well as chairman emeritus of Liberty Flour Mills. He is survived by his wife of 61 years, Angeles; his sons, Benjamin, Jose, and Jesus Jr.; and his daughters, Maria Lourdes and Anna.



**GEORGE KINSEL** '55 died on March 31, 2008. Born in Altoona, PA, he travelled west to attend Mines immediately after leaving high school. Prior to completing his degree in petroleum engineering, he served as a Navy pilot in Japan and Korea from 1951 until 1952. In subsequent years, he continued to serve in the Naval Reserve squadrons in Denver and Dallas. After Mines, he completed graduate studies at

Carnegie Institute of Technology. George married Helen K. Byer in 1960. During his career, he worked for Reda Pump, Primerica Life Insurance, Thermopolis Travel Service, several oil companies in the Rocky Mountains, and the Conservation Division of the U.S. Geological Survey. George spent his free time swimming, working out in the gym, hunting, fishing, and playing tennis. He was active in his church, the Lion's Club and volunteered for Meals on Wheels. He is survived by his wife, Helen; their children, Sheila Sue Anderson and Troy; a daughter and son from a previous marriage, Karen and Bruce; and two granddaughters.



**MARTIN LESSER** '55 of Boca Raton, FL died on October 30, 2007. He received a degree in geological engineering at Mines, where he was a member of the Blue Key Society and Beta Theta Pi. After completion of his military service at Fort Bragg, NC, he switched career paths, joining IBM as a computer analyst in 1962. He worked in the Strategic Air Command base near Omaha, NE, before transferring to IBM's personal computer

division in Boca Raton, FL, where he worked until his retirement in 1994. He is survived by his wife, Mickey; two sons; a daughter; four brothers; one sister; and four grandchildren.

**RICHARD RAY LORING** '38 died on April 9, 2007. Born in Lewiston, ID, he graduated from Mines with a degree in petroleum engineering. During the early years of his career, he worked for Texaco in Bogota, Columbia for four years. He spent three years in the South Pacific during World War II as a lieutenant in the U.S. Navy. Upon his return, he returned to Texaco for a time, before transferring to W. C. McBride Oil Co., where he worked for 33 years, primarily as a production manager. Before retiring, he worked independently as a petroleum consultant for five years. Richard is survived by his wife of 64 years, Medie Reeve; their daughter, Sandra Goodson; two grandchildren; and five step-grandchildren. He was predeceased by his son, Reeve Ray; his parents; his brother, Ralph; and two stepdaughters, Delores Gaines and Charlotte Singleton.



**KENT MILLER** '54, MS '59 of Kerrville, TX died on March 31, 2008. Kent was born in Roswell, NM and grew up in Midland, TX. The son of Milward K. Miller '26, Kent played football for Mines for all of his undergraduate years. On campus, his conspicuous height and red hair earned him the nickname "The Big Red Goose"—affectionately shortened to "Goose."

Graduating with a degree in geology and geological engineering and a master's in metallurgical engineering, he went on to receive an MBA from the University of New Haven, CT. After serving in the U.S. Army during the Korean War, Kent spent most of his career in West Virginia and Connecticut working as a production manager for Republic Foil, United Nuclear, Criterion Metals and Pfizer Inc. Kent was an ardent and talented golfer and an avid reader. He loved animals, classical music and cooking, and he was devoted to his family. Kent is survived by his wife of 20 years, Carol Miller; his sons, Mark and Kevin; his daughters, Leslie Gustafson and Piper Sudweeks; nine grandchildren; one great-grandson; six stepchildren; and his sisters Marilyn Hanson, Mary Jane Andrews, and Margie Nagle.



**MATTHEW S. MITCHELL** '00, MS '06 died at his home in Bremerton, WA on August 17, 2007. A Colorado native, he grew up in Thornton and attended Horizon High School, where he was the valedictorian of his class in 1996. After earning his chemical engineering degree from Mines in 2000, he worked for the ATMEL Corporation in Colorado Springs for several years. He then returned to Mines, where he completed his master's degree in chemical engineering in 2006. At that time he took an engineering

position with the Department of the Navy at the Puget Sound Naval Shipyard, where he worked until his death. He enjoyed hiking and biking in the mountains of Colorado and Washington. He was predeceased by an infant brother. He is survived by his mother, Elizabeth; sister, Jennifer; father, Bruce; step-mother, Janice; and numerous family and friends. All dearly miss him. Contributions may be made to the Matthew Stewart Mitchell Memorial Scholarship Fund through the Colorado School of Mines Foundation.



**DALE L. ROBERTS** '50 of Norman, OK died on October 9, 2007. Born in Stafford, KS, he later moved with his parents to Colorado and graduated from Wheat Ridge High School. During World War II, he served as an aviator in the U.S. Navy. In 1948, two years before graduating with a degree in geological engineering, he was

married to Emma Rudy in Colorado Springs. After graduation, he worked as a geological engineer for the Atomic Energy Commission, which took him to Peru; Ideal Cement in Ada, OK; and Mustang Fuel in Oklahoma City. In his free time and after he retired, Dale spent his time ranching, training horses and raising his family. He was a member of the American Quarter Horse Association, and a loyal member of the Church of Christ, who also served on the Board of Development and Board of Directors of the Oklahoma Christian University. He is survived by his wife of 60 years, Emma; his daughters, Alana Knight and Gail Brazle; a sister, Elaine Wells; a brother, Neal; five grandchildren; and four great-grandchildren.

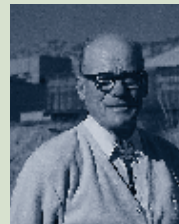


**GEORGE EDWARD ROBERTSON** '41 of Truckee, CA died on June 23, 2007. After earning his degree in petroleum engineering from Mines, he spent six months working for Phillips Petroleum before beginning service with the Army Corps of Engineers. During World War II, he spent two years in Alaska constructing airfields and housing in support of operations in the Pacific theater. He then spent six months in the Philippines

building petroleum storage and pipelines. After the war, he worked for various companies before opting to run his own small business until his retirement in 1974. Known for his commitment to community service, George received the Nevada County Senior Hero of the Year award in 1998, the U.S. Presidential Volunteer Service Award from President Bush in 2005 and was presented with the Key to the Town of Truckee by the Truckee Town Council and Mayor in 2006 for his steadfast attendance at virtually every Town Council meeting since the Town's incorporation—this latter achievement earned him the nickname of the “Voice of the Public” and Truckee’s “Sixth Council Member.” In 2003, he earned an award for 2000+ hours of volunteering from the Tahoe Forest Hospital. A devout Christian, he devoted time to the First Baptist Church of Truckee as both an administrator and a Sunday school teacher. He is survived by his wife of 65 years, Ellen; his daughters, Margaret Holmes and Barbara Robertson; his son, G. David; seven grandchildren; and three great-grandchildren. He was predeceased by his brother, Vernon; and his sister, Blanche Norcross.

**WILLIAM EVERETT SHERBONDY** '40 of Cory, CO passed away on September 8, 2007. He was born in Aspen and graduated from North Denver High School. He earned his degree in geological engineering from Mines and a year later married Beatrice Hagen. His 14 years of service with the U.S. Marine Reserves concluded with an honorary retirement as major. The majority of his career was spent as a topographical photogrammetrist with the USGS, where he was valued as one of their best cartographers. He moved from Lakewood to Cory after his retirement in 1973, where he enjoyed reading, farming his four acres, volunteering for his

church and many do-it-yourself projects. He is survived by his wife of 66 years, Beatrice; his daughters, Nancy Turner, Norma Stroupe and Nina White; seven grandchildren; and eight great-grandchildren.



**HARRY L. SHIVELY** '51 passed away on November 21, 2007, in Oro Valley, AZ. He was born in 1919 on a farm near Mt. Summit, IN into a family of twelve children. After graduating from high school, he worked for his uncle on a construction crew; the job took him west to Colorado where he met his wife, Marietta. In 1942 he joined the U.S. Air Force and was

trained as a navigator on B-29 Bombers. For much of his tour of duty, he was stationed on the Pacific island of Saipan. After honorable discharge with the rank of captain, he came to Golden to complete his degree in mining engineering. After graduation, he initially worked in coal mining in Utah, but in 1953 took a job with Duval Corporation. Over the next 30 years, he worked in potash mining in New Mexico and Saskatchewan, Canada; in sulphur mining in Texas; and in copper mining in Arizona. He retired from Duval in 1984 and, until very recently, continued to do the things he loved best—auto restoration, golfing and bowling. He is survived by his wife of 63 years, Marietta; his daughters, Marilyn O'Brien and Cindy Phelps; two sisters; three brothers; four grandchildren; and three great-grandchildren.



**CHARLES L. YARBROUGH, JR.** '64 died at his home in Arnold, CA on December 18, 2007. Having earned his degree as a petroleum engineer from Mines, he spent several years working for Gulf Oil Company in Midland, TX; Bakersfield, CA; Houston, TX;

London; and Lagos, Nigeria. He subsequently became a property restorer in California—his latest project was in the Sierra Nevada Mountains near Angels Camp. He is survived by his mother, Val; his son, C.L. Yarbrough III; his daughters, Amy and Jennifer; and seven grandchildren.

### Also In Memoriam

<b>Roy R. Albertzart</b> '58 .....	Feb, 1982
<b>Donald G. Foot</b> '38 .....	Sept 26, 2001
<b>Hurley D. Pepper</b> '50.....	Feb 4, 2007
<b>Basil V. Savoy</b> '47 .....	July 30, 2007
<b>Joseph A. Scheuering</b> '67.....	July 6, 2007
<b>Samuel A. Spencer</b> '47.....	Nov 25, 2005

## Parting Words

By Casey Morse

When I arrived in Golden in the fall of 2003, I had only a few possessions. I brought with me some clothes, a bike and my skis. I also had some excitement, some fear and a sense of self I thought would remain impervious forever. In my eyes the world was small, and I had already established my place and myself. All



I had left to do was get a bachelor's degree before I could get to work.

I could not have been more wrong. While I graduate and leave Mines with most of the same clothes, my bike and skis, some excitement, and some fear, my attitude and outlook on the world have turned around completely.

Mines has taught me and many others that the world is an enormous and complex array of interacting systems. Every one of us has a role within our respective system to not only promote its success, but also its successful interaction with all of the people, cultures, politics and economics of those surrounding systems.

In this regard, I leave Mines with less certainty about my place in the world than when I arrived. I have a job title and I know where I will be living; but knowing that my actions and decisions can have implications that can cascade far beyond their intended objective leaves me with a much greater sense of responsibility to my local and global community. To positively impact humanity with the knowledge I gained as an engineer is my professional responsibility, but a greater sense of the world's complexity has magnified this challenge.

Nevertheless, I am proud to enter the workforce with the technical competency and heightened sensitivity and sense of responsibility that I received at Mines. I am proud to be associated with so many peers and classmates with great accomplishments and great potential. Most of all, I am proud to enter into a closely connected community of accomplished alumni.

This is an amazing time to be a Mines graduate, and I wish the best of luck to all of my classmates for their future endeavors.

Thank you,

Casey Morse

Class of 2008 – Chemical Engineering and Economics

Former President of Associated Students of Colorado School of Mines (ASCSM)

# We Saved The Plate!



Following a lively campaign in its defense, Mines license plates are back on sale. Anita Pariseau, the executive director of the Colorado School of Mines Alumni Association, appeared twice before House and Senate transportation committees to speak in support of a bill that would enable most small colleges and universities in the state to keep their plates. In an encouraging show of support for higher education, the bill was approved by the General Assembly and signed into law by Gov. Ritter in May. We still have to keep a minimum threshold of plates on the road—500 instead of 3,000—so you are invited to do your part by getting yours today. Go to [www.minesonline.net](http://www.minesonline.net), click *Merchandise*, and select *License Plates*, or call 303.273.3424.

Thank you for all the support and patience!

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