



# Mines

Colorado School of Mines Magazine

Lighting the Way to  
Renewable Energy Solutions

# 2008 Reunion

Save-the-date!

## May 7-10, 2008

Honoring the following classes:

The Golden Miner Classes (50<sup>th</sup> and up), 1958, 1963, 1968, 1973, 1978, 1983, 1988, 1993, 1998, 2003

And welcoming back their neighboring classes:

1962, 1964, 1967, 1969, 1972, 1974, 1977, 1979, 1982, 1984, 1987, 1989, 1992, 1994, 1997, 1999, 2002, 2004

Thursday, May 8

**Graduation and Alumni Banquet,  
including alumni awards**

To nominate, please go to <https://www.oia.mines.edu/forms/awards/awards2.htm>

Friday, May 9

**Class Reunion  
Dinners**

Also plan to attend tours, seminars, special events,  
departmental receptions and much more.



For more information, please call: (303) 273-3295 or (800) 446-9488, extension 3295

E-Days 'Round the World is 'round the corner in a city near you!

Join Miners in  
your area as  
alumni 'round the  
world gather for  
mixing, merriment  
and to fondly  
remember E-Days.

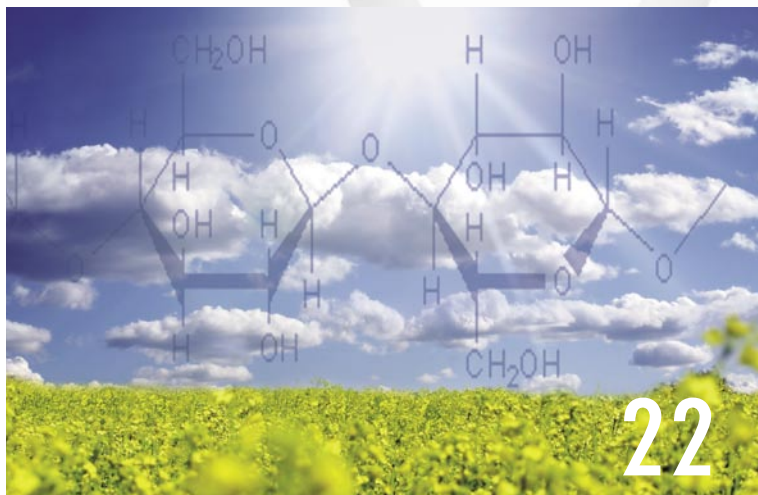
Save the Date for

# 2008

Thursday, April 3, 2008

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## Thoughts and Comments on the Redesigned Mines Magazine

Impressive layout and very interesting articles, especially the ones on lasers and nanotechnology. Mines magazine gives a good overall view of what is happening on campus.

**Jon Bennett '88**

I like the new format, but better yet, I like the new content. Good job!

**Gregory Davoll '89**

Certainly a great improvement! Keep up the good work.

**Bob Garland '52**

I truly disliked the format of the "redesigned" magazine, particularly the alumni news section. I appreciated the old format, with everyone's news

mixed in by graduation year, instead of a baby section and a wedding section—made more sense the other way. Plus, where did the degree information go? We earned them, so why isn't it listed anymore? Very disappointing for a "redesign."

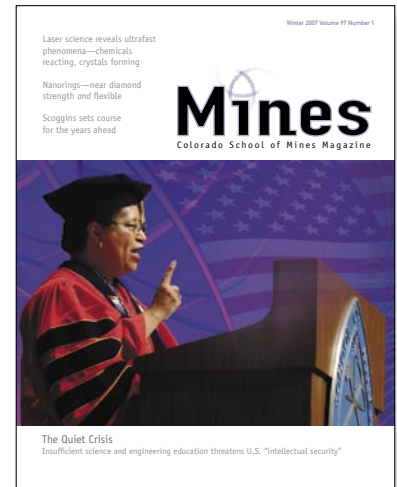
**Shelan Golightly '01**

I think the latest Mines Magazine was excellent. The article on nanotubes was particularly interesting. Keep it up!

**Dennis Gregg '50**

The magazine keeps getting better. Keep it up!

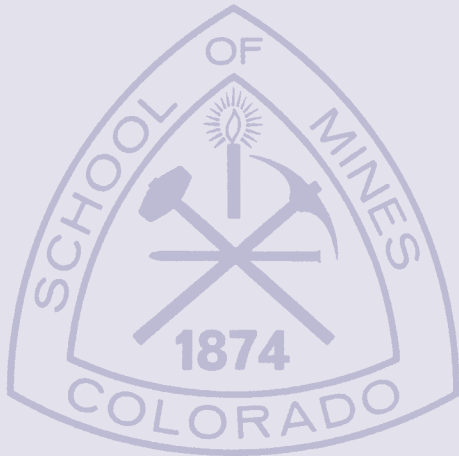
**Larry Melzer '39**



**Editor's note:** We are grateful for all the feedback we received on the redesigned magazine. If you have additional suggestions, we want to hear them. Please send comments to [magazine@mines.edu](mailto:magazine@mines.edu). One additional change has been made to the Fast Forward section: information concerning marriages and births accompanies photographs, and is now also listed in Class Notes.

**Mines Online:**  
[www.mines.edu/magazine](http://www.mines.edu/magazine)

Mines will soon be launching an online, fully-searchable version of the magazine, featuring material from the print version, plus extra content we didn't have space to include. An archive page will give access to previous issues (we'll continue to make pdf versions available as well). And a link to the Fast Forward submission page will make updating us with your personal information easier than ever. If we have a current e-mail address for you, we'll let you know when the site goes live. If not, keep an eye on [www.mines.edu/magazine](http://www.mines.edu/magazine)—it won't be long!



Spring/Summer 2007  
Volume 97 Number 2

[www.mines.edu](http://www.mines.edu)  
[www.csmma.mines.edu/alumni](http://www.csmma.mines.edu/alumni)

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CSM Alumni Association

**Nick Sutcliffe**

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

Comments and suggestions are welcome. Contact us by writing to *Mines* Magazine, P.O. Box 1410, Golden, CO 80402; or call 303-273-3294 or 800-446-9488, ext. 3294 between 8 a.m. and 5 p.m. M-F, MST; or email [magazine@mines.edu](mailto:magazine@mines.edu).

## Dear Readers,

This is the first edition of *Mines* magazine I've overseen from start to finish since taking over as editor, and I'd like to take this opportunity to say how excited and honored I am to be serving in this position. During the five years I've spent working at Mines—initially as a writing instructor and later as a writer—I developed immense admiration and respect for Mines' students, faculty and alumni. Such a great school deserves a great magazine, and in the years ahead I will be doing my best to make sure this continues to be the case.

One way you can help us succeed in this is to provide feedback. If you read something you like, we'd love to hear about it. If you read something you don't like, we need to hear about it. This is your magazine, and a dialogue between staff and readers can help us shape a publication you look forward to receiving each quarter.

One easy way to give us feedback is by visiting the new *Mines* magazine website, detailed on the facing page. The URL is easy to remember—[www.mines.edu/magazine](http://www.mines.edu/magazine)—and there is a "contact us" button on every page. Use it to share your thoughts on a story, provide updates for Fast Forward or suggest a story we might want to cover.

Regarding this current issue, several of the stories relate to the growing national and international debate on energy. With concerns about U.S. dependence on foreign oil being compounded by growing evidence of climate change, many are looking to Mines for solutions. Given our historical leadership in the energy industry, this is to be expected. Nevertheless, it speaks well of our adaptability and intellectual depth that we are helping lead the quest for solutions, while continuing to enhance our traditional portfolio of energy-related programs.

Along with our expertise in energy, Mines is a leader in engineering education. In the last issue we included a speech delivered at Winter Convocation by Shirley Jackson, president of Rensselaer Polytechnic Institute. After publishing her concerns about the state of engineering education in the U.S., it seemed appropriate to highlight how well Mines performs in this area. We could have pulled together statistics and charts to build the case, but instead we chose to write a story about EPICS—a course sequence that has become a centerpiece of the Mines undergraduate experience. The specific project we chronicle is just one of many success stories, but it gets to the heart of the program and to the heart of a Mines education.

Thank you for reading and thanks for your loyalty to Mines. I look forward to hearing from many of you in the form of a "letter to the editor," a Last Word submission or an informal email.

Best wishes for these precious summer months,

Nick Sutcliffe

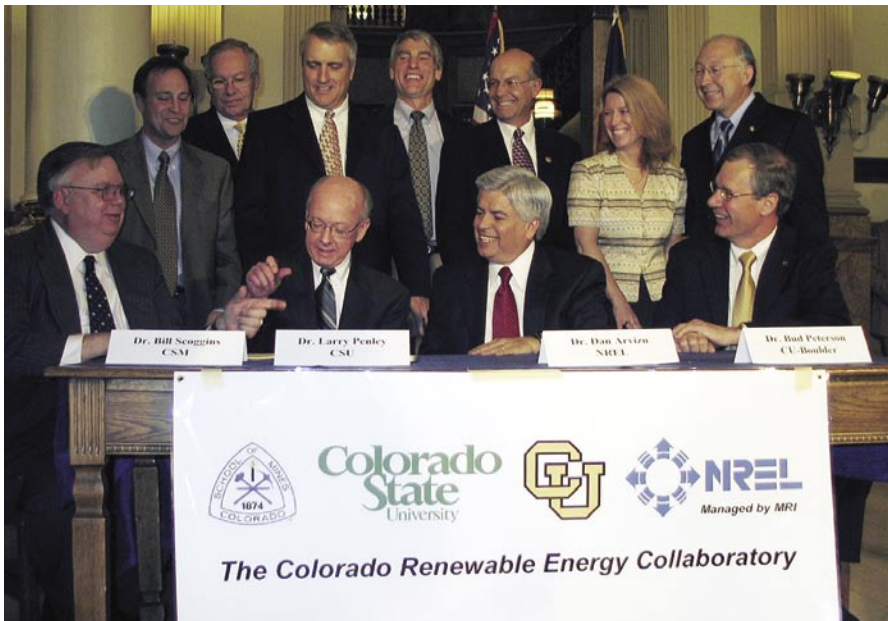
Editor and Director of Communications, CSMMA

P.S. This is being called the "spring/summer" issue because the production cycle has shifted forward one month. The next issue will be titled the "fall" issue and will arrive in early Oct.

# Campus News

## Mines Partners in Energy Collaboratory

In Feb., an agreement creating the Colorado Renewable Energy Collaboratory, an association of Mines, the University of Colorado (CU), Colorado State University (CSU) and the National Renewable Energy Laboratory (NREL), became official.



Leaders from the four institutions, including NREL Director Dan Arvizu, CSU President Larry Penley, Mines President Bill Scoggins and CU-Boulder Chancellor Bud Peterson, signed the agreement during a ceremony in the west foyer of the state Capitol. Gov. Bill Ritter, U. S. Senators Ken Salazar and Wayne Allard and Congressmen Mark Udall and Ed Perlmutter spoke at the kickoff.

“Colorado School of Mines fully commits its worldwide expertise in the areas of earth, energy, materials and the environment to this critical partnership, which will make the Front Range the nation’s center of renewable energy technology development and commercialization,” Scoggins said.

The Collaboratory, dedicated to performing world-class research to develop new energy technologies and to transfer these advances as rapidly as possible to the private sector, has already spawned its first program—the Colorado Center for Biofuels and Biorefining, nicknamed C2B2 (see story page 22).



## Volpi Named VP

Kirsten Volpi has been named vice president for finance and administration and will serve as the School's chief financial officer and treasurer of the Mines Board of Trustees. She will oversee the consolidation of all financial activities and reporting on campus.

Volpi, who joined Mines in 2005, previously served the School as associate vice president for finance and operations, and controller.

## Scoggins Among Energy Leaders Discussing Industry's Future

Mines President Bill Scoggins was invited to attend the 2007 CERA Week held in Houston in mid-Feb..

CERA Week was organized by Cambridge Energy Research Associates, the highly acclaimed energy consultancy and research group headed by Daniel Yergin, author of *The Prize*. Attendees included energy leaders and dignitaries from around the world. The theme, "Strategies for a High Stakes World: Innovation, Investment, and the Future of Energy," aimed to capture the essence of the challenges facing the global energy industry.

Also in attendance, professor Tony Dean participated in "Transportation and Fuel Options," a breakout session held as part of the CERA/Massachusetts Institute of Technology Energy Technology Summit. The special session had about 150 participants including representatives from only two universities—Mines and MIT.



## Golden, Mines Show Off for NCAA

Mines and the city of Golden were chosen as one of five communities in the U.S. to showcase to NCAA officials how a university, business community, residential community and local government work together to promote, resolve, network, work, live and play together.

The event, "An Evening in the Park," was sponsored by Mines, the Greater Golden Chamber of Commerce, Downtown Merchants and the Golden Cultural Alliance. It was held on Kafadar Commons on the Mines campus in April.

Free activities included live music, food, carriage rides, train rides, games and panning for gold.

## Climate Action Days Provide Plenty of Action

The Mines Sustainability Committee presented Climate Action Days in April to build awareness of global climate change, renewable energy technologies and related political issues. The event featured a keynote address,

"The Future of Planet Earth and its Inhabitants: Our Assessment of the

Climate Problem and Possible Solutions," by Dr. Tim Killeen, director of the National Center for Atmospheric Research (NCAR), and Tom Plant, director of the Colorado Governor's Energy Office. There was standing room only available for much of the day-long symposium that followed, which included speakers from Mines, the National Renewable Energy Laboratory, the University of Colorado, the National Oceanic and Atmospheric Administration and NCAR. Visitors to the event also saw biodiesel displays, an eight-foot scale model wind turbine and a game of "globo-ball," a cross between soccer and professional wrestling in which teams of four attempted to save the Earth. In conjunction with Climate Action Days, the Mines Earth Works student organization held its traditional Earth Day celebration featuring live music, food and beverages.





## Professor Awarded Fulbright

Junko Munakata Marr, associate professor of Environmental Science and Engineering, has been awarded a Fulbright Scholar grant to lecture and conduct research at Silpakorn University, Bangkok, Thailand, during the 2007-2008 academic year, according to the United States Department of State and the J. William Fulbright Foreign Scholarship Board.

Marr will research biological nutrient removal in centralized and distributed wastewater reclamation systems and lecture on wastewater treatment and water reclamation. Marr is one of approximately 800 U.S. faculty and professionals who will travel abroad through the Fulbright Scholar Program.



## SWE Brings Conference to Campus

The Mines chapter of the Society of Women Engineers (SWE) hosted the organization's regional conference in March.

The event featured entertainment and seminars as well as campus and Coors brewery tours for more than a hundred attendees from schools including Kansas State University, University of Missouri, University of Wyoming, University of Nebraska and Pittsburg State University.

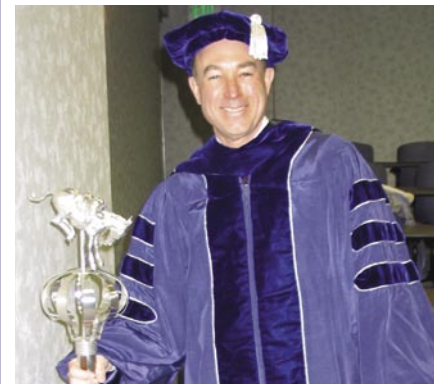
Over the past 10 years, women have comprised 21 to 26 percent of the student population at Mines. Impressively, Mines' SWE section has more than 315 members, making it the second largest section in the nation and the largest student organization on campus.

## Van Kirk to Step Down

After nearly 30 years on the faculty at Mines and 26 years as head of the Department of Petroleum Engineering, Craig Van Kirk has announced he will step down as department head effective at the end of the 2007 spring term.

Van Kirk will retain his tenured professorship and continue with assignments related to petroleum engineering and the institution.

Prior to joining Mines in 1978, Van Kirk worked in the petroleum industry in the areas of exploration, drilling, production and reservoir management. At Mines he has taught many undergraduate and graduate courses. He has also supervised graduate students on research in the areas of reservoir management, economic evaluation, computer simulation, and enhanced recovery, and in the process managed several million



dollars in funded research sponsored by the U.S. Department of Energy, Department of Education, the Gas Research Institute and private industry.

Van Kirk has provided testimony to the U.S. Congress and National Academies on topics of national energy concerns, and he has been an invited speaker for numerous events, private companies and government agencies around the world. A Distinguished Member of the Society of Petroleum Engineers (SPE), Van Kirk has served as the faculty adviser for the Mines student chapter, as well as chairing committees and serving on the SPE Board of Directors on an international level. He is a Registered Professional Engineer and a member of the National Society of Professional Engineers.

## Students Test Spaghetti Towers

The Minority Engineering Program and Office of Undergraduate Admissions hosted 300 high school students for the Colorado Mathematics, Engineering, Science, Achievement (MESA) High School Jamboree on April 12.

The jamboree drew students from around the state to participate in math, engineering and science competitions including the Spaghetti Tower Earthquake Test, Trebuchet Challenge, Gumdrop Dome and individual oral presentations focused on possible solutions for rebuilding the storm-damaged levees in New Orleans.

The event encouraged teamwork, parent and teacher involvement in student activities, and responsibility and integrity among students.





## State Appointment to Mines Student

Mines graduate student Robert Applegate has been appointed student representative to the Colorado Commission on Higher Education Advisory Committee.



Applegate, who is working toward a doctorate degree in applied physics with a minor in applied optics, earned his bachelor's

degree in 2003 from Mines in engineering physics with a minor in public affairs for engineers through the Guy T. McBride Jr. Honors Program.

The commission solicited nominations from the presidents of all Colorado colleges. Applegate will represent Colorado students for a full calendar year.

One of the committee's roles is to suggest solutions for the problems and needs of higher education. Applegate said he hoped to bring the issue of student costs to lawmakers' attention.



## Fraternity Promotes Ski Helmets

The 9th Annual Ski-A-Thon hosted by Beta Theta Pi Fraternity was held in Feb. at Arapahoe Basin Ski Resort to encourage the wearing of ski helmets to prevent serious injuries and save lives.

The fraternity members boosted their fundraising efforts by selling raffle tickets at this year's Wellness Fair – an event aimed at promoting healthy lifestyles within the Mines community.

Over the years, the fraternity has raised tens of thousands of dollars for the Saint Anthony Hospitals Inter-mountain Neurosurgery helmet donor program.

## Mines Hosts Lecture, Energy Open House

The second event in the President's Lecture Series, "Energy, CO<sub>2</sub>, and Global Change: Technology Research for a Greenhouse World," was presented in March by Franklin M. (Lynn) Orr Jr., director of the Global Climate and Energy Project at Stanford University.

The lecture ran concurrent with an energy open house hosted by President Bill Scoggins and John Poate, vice president for research and technology, on behalf of the newly formed Colorado



Renewable Energy Collaboratory. Both events coincided with the March meeting of the American Physical Society (APS) held in Denver.

Mines community and APS guests visited research facilities on campus, including the Colorado Fuel Cell Center, a characterization laboratory for the Colorado Energy Research Institute, a femtosecond spectroscopy laser laboratory, and the Physics Learning Studio.

## E-Days Surprises

Despite a snowy kickoff to this year's safari-themed Engineers' Days, the annual celebration was a hit among students, alumni and the community.

Hundreds of students participated in the traditional Ore Cart Pull down Colfax Avenue to the state



Capitol. Following Lt. Gov. Barbara O'Brien's proclamation declaring March 29-31 as the 72nd Annual Engineering Days in Colorado, Mines student Kenton Larson surprised



fellow student Andrea Crussell with a marriage proposal on the Capitol steps. As the crowd cheered, Andrea said yes.

Other E-Days activities included a concert, the annual cardboard canoe race on Clear Creek, a car show, field events and the ultimate miner competition.

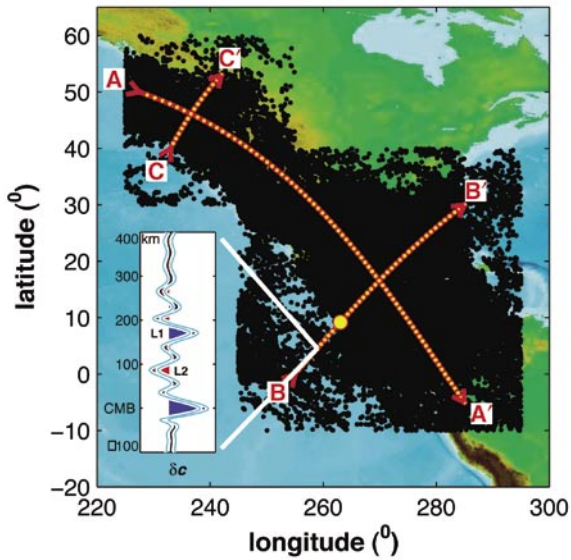
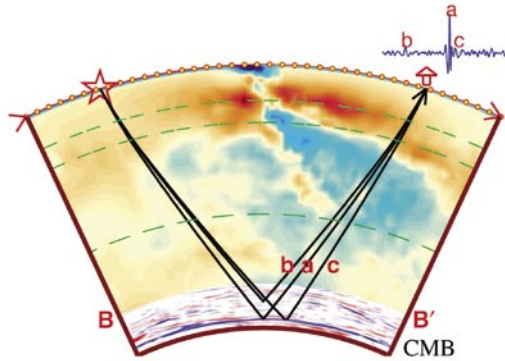


## NASA In Deep Water

To the uninitiated, it's not immediately obvious why NASA would be sponsoring an expedition into the deepest known sinkhole on Earth. On the other hand, the involvement of Environmental Science and Engineering Professor John Spear is a little more apparent—he's a microbiologist and in this more than 1,000-foot deep, warm, water-filled and mineral-rich cave known as El Zacatón, the microbial life is fairly unusual.

Below 30 meters there is no light or oxygen, yet life abounds. "The walls are lined with spongy red and purple microbe mats," says Spear. Jim Bowden, a deep water diver, dove to 82 meters and brought back samples in which 27 divisions of bacteria were identified, including six new divisions. "The diversity is astounding. I think that if we get down further, there will be even more," Spear says. There may even be whole ecosystems in the depths of El Zacatón that are entirely independent of photosynthetic energy, instead metabolizing sulphides from volcanic plumes.

However, Bowden won't be diving any deeper to find out—82 meters is way past the limit of most recreational divers. Instead, starting in mid-May, the expedition will be using a highly sophisticated autonomous robot called the Deep Phreatic Thermal Explorer (DEPTHX). Loaded with a total of 30 computers and able to use sonar, temperature, pressure and light to self-navigate as it searches for environments likely to support life, DEPTHX might be the most sophisticated robot ever designed for autonomous exploration. Of course this is where NASA's interest lies—DEPTHX was designed as a prototype for a vehicle that might someday go looking for life in the ice-covered oceans of Jupiter's moon, Europa.



## Imaging the Earth's Core Mantle Boundary

Luis Tenorio, associate professor in the Department of Mathematical and Computer Sciences, is participating in an NSF-funded project to image the earth's core mantle boundary (CMB). The collaboration includes geophysicists, mathematicians and statisticians from MIT, Purdue and the University of Illinois. Their results, published in the *Journal of Geophysical Research* and in *Science*, clearly show structures at two depths close to the CMB, and the existence of new phase transitions in the mantle.

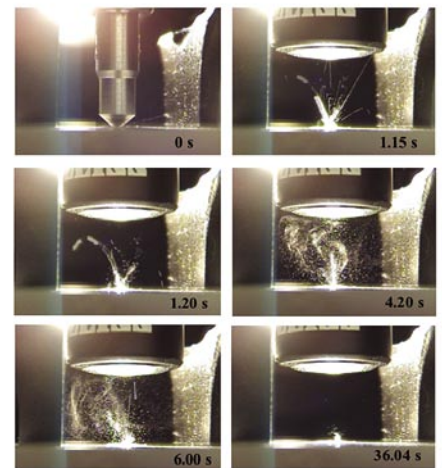
The team's methodology involves a rich mix of physics, mathematics and statistics to extract information from seismic wave data through "inverse scattering." Whereas in the past, existing knowledge of geophysical structures was used to interpret scattering patterns, this method allows researchers to take scattered wave data and reconstruct an image of the subsurface without relying on existing knowledge. Combined with considerably better data coverage, this advance in imaging is leading to a rapid expansion in our knowledge of the subsurface and the inner workings of the planet.

## Smokin' Ceramics

Materials and Metallurgical Engineering professor, Ivar Reimanis recently discovered a unique material behavior in which particles are ejected from the surface of an indented ceramic over periods lasting up to a few minutes. Because many of the ejected particles are submicron in size, it looks to the unaided eye like the ceramic is smoking. The key ingredient in the ceramic is a lithium aluminum silicate called  $\beta$ -eucryptite, a strange material that has a negative coefficient of thermal expansion. It is thought that a high compressive stress, such as that experienced under an indenter, stimulates a transformation to a denser ceramic phase. Upon release, a reverse transformation leads to a popcorn-like effect where particles ranging from submicron to 50 microns are ejected violently from the material. There is no known report of this phenomenon in any other material. With assistance from undergraduate students Chris Seick and Kyle Fitzpatrick, Reimanis is exploring whether this discovery can inform development of a toughened ceramic composite—the phase transformation may be able to shut cracks before they can propagate through a composite. In fact, this latter idea has already been submitted for a United States patent. To better understand the phenomenon, the Mines researchers have involved collaborators at the National Institute for Standards and Technology in Gaithersburg, the Los Alamos National Laboratory and the Indian Institute of Science. The work is being supported by the U.S. Department of Energy, Office of Basic Energy Sciences.



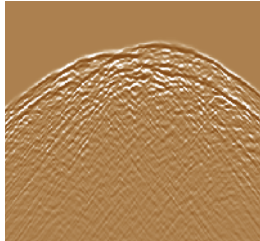
High speed photography showing particle ejection.



Particle ejection captured with a video recorder.

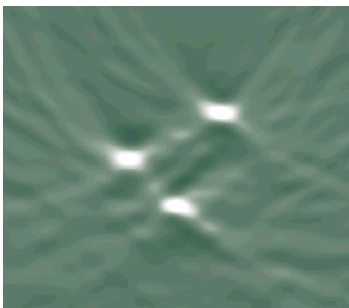
## Enhanced Imaging of the Subsurface

Paul Sava, who joined the Department of Geophysics faculty in the fall of 2006, is working on increasing the accuracy of seismic imaging. When computers generate a visual representation of the subsurface from a seismic dataset, finer details are often obscured by background “noise.” While imaging may provide a coherent overall picture, it emerges from a fuzzy background, much as a badly oriented TV antenna produces a poor image. The noise is created by random sound waves that are inevitably recorded during seismic surveying. This random data makes finer details of the subsurface indistinguishable—only “louder” signals emerge from buzz. Sava’s work aims to cancel out background noise and bring



Simulated seismic data corresponding to three sources embedded in random “noise.”

more subtle features into focus. Instead of imaging data received at individual locations, he takes information recorded at multiple nearby sites and mathematically compares them. Data that bears no relation across sites is filtered out, leaving only spatially coherent information. Essentially, he is mathematically cross-checking the data received at multiple nearby sites and building an image from only the information that is corroborated. The result is greatly enhanced imaging, as the accompanying illustrations demonstrate.



Conventional imaging of simulated data from a single site.



Imaging based on filtered data corroborated at multiple sites.

## Reservoir Characterization Project Enters Phase XII

Geophysics Professor Tom Davis presented results of Phase XI of the Reservoir Characterization Project (RCP) to a packed house of sponsors April 12-13.

The Phase XI project focused on nine-component, full wavefield seismic data collected at Rulison Field, in Western Colorado’s Piceance Basin. Three multi-component seismic surveys were acquired in 2003, 2004 and 2006 across the same area, enabling interpretation of the efficacy of time-lapse data. Additionally, a downhole test that measured in-situ pore pressure was carried out on a field well within the study area, and multi-component micro-seismic data were recorded during a four-stage hydraulic fracture treatment on a nearby well.

To date, RCP’s Phase XI graduate students have concluded that shear waves are the most valuable wave mode for characterizing and monitoring Rulison’s Williams Fork and Iles tight-gas sands. The RCP project also validated the use of nine-component seismic data for detecting faults and fractures, detecting and predicting lithology and pressures, monitoring reservoir connectivity and depletion, and locating prime well locations.

Pressure-test results were able to show a correlation with depletion zones that were predicted from time-lapse shear-wave data. Furthermore, the data showed coincidence with depleted areas in the Cameo Coal interval.

High-resolution dynamic reservoir characterization appears to be a key technology for tight gas, said Davis, as it gives operators the potential to improve recovery efficiencies.

Going forward, RCP is circulating research proposals for its Phase XII project. Under consideration is dynamic reservoir characterization on Postle Field, in Texas County, OK. Postle’s Morrow reservoir is undergoing enhanced oil recovery using CO<sub>2</sub>, a very germane subject in today’s oilfield.

—Excerpted from *Oil and Gas Investor*

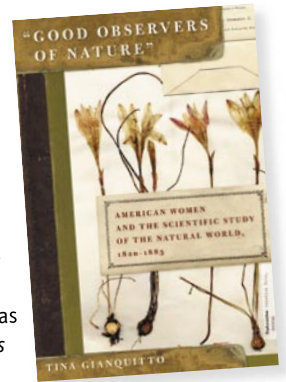
**“What Goes Down Must Come Up”**

Carol Dahl, professor of economics, recently published an article for API that discusses the tripling of U.S. gasoline prices between Jan. 1999 and July 2006. Consumers, policymakers and the media have questioned why prices rose so quickly and why they remain so high. In this paper, Dahl evaluates the forces thought to be influencing price trends. One of her key observations is that recent price patterns are not unprecedented and are mirrored in the price behavior of other commodities. She argues there is no evidence refiners have been able to block the behavior of a competitive market, pointing out that higher profits have been accompanied by normal inventory and investment practices. Instead, she argues that escalating prices can be attributed to the increased cost of crude oil, higher operating costs, proliferating grades of gasoline, unexpected growth in demand, lower demand responsiveness, recovery from low and negative rates of return on investment in the 1990s, hurricanes and regulatory uncertainty.



**Good Observers of Nature: American Women and the Scientific Study of the Natural World, 1820-1885**

Tina Gianquitto, assistant professor in the Division of Liberal Arts and International Studies, has recently published *Good Observers of Nature* (University of Georgia Press, June 2007), a book examining Nineteenth-Century American women’s intellectual and aesthetic experiences of nature and the linguistic, perceptual and scientific systems employed to describe those encounters. By discussing a range of women’s nature writings from the 1820s to the 1880s, the book makes observations about the interaction of reason and emotion in the study of nature; the best vocabularies for representing objects in nature; and some competing systems for observing, studying, and ordering the natural world.



**We Prepare Leaders for Global Resources Challenges**



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The curriculum is organized into five thematic areas:

- International Political Economy: Theories and Methods
- International Political Economy of Regions (Latin America, Asia Pacific, the Middle East, and Sub-Saharan Africa)
- Global Resources Development
- Global Resources Security
- International Political Risk Assessment and Mitigation

The MIPER program now offers J. Michael Blackwell Fellowships.



{Find out more about the MIPER program at <http://miper.mines.edu>}

Dr. Eul-Soo Pang, MIPER Program Director  
Division of Liberal Arts & International Studies  
<http://miper.mines.edu>

Colorado School of Mines  
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## Hard Hitting Softball Team Ends Record Season

The Colorado School of Mines softball team started out the 2007 season slowly, but came on by midseason to finish the year with a school-record 25 wins. The victory total surpassed the previous record of 22 wins set in 2002 and repeated in 2004.

CSM's opening two weekends were both snowed out in early Feb., meaning the Orediggers did not play their first doubleheader until Feb. 25 at Colorado College. But the wait was well worth it.

In the season opening doubleheader, the Orediggers swept Colorado College, 30-0 and 6-0. In game two, sophomore pitcher Taylor Cayou fired a perfect game. She didn't walk a batter, struck out eight, and was aided by CSM scoring three runs in the third inning and three more in the seventh. Cayou retired seven Tigers via groundballs and six by flyouts.

The Orediggers then opened up conference play by dropping seven of their first eight games, but rallied during its spring break trip to Tucson to post a 5-3 record in the desert.

After the trip south, the Orediggers returned to Colorado and went 17-12 over the final seven weeks of the season. Included in the streak were four-game splits on the road with Western New Mexico and UC-Colorado Springs, the teams that finished second and third in the conference.

Over the final two weekends of the season, the Orediggers won a combined 6-of-8 games from New Mexico Highlands and Chadron State and wound up winning nine of its final 14 games. Despite the hot streak to end the season, CSM missed out on qualifying for the RMAC Tournament as it finished seventh in the overall standings. The top six teams qualified for the tournament.

Several CSM players enjoyed outstanding seasons, but none more so than seniors Beth Skidmore and Brianne Brennan. The senior duo finished their careers by winning 81 games, the most by a senior class in softball history.

In addition, Brennan finished her career as the all-time leader at CSM in home runs (16), runs batted in (107), hits (169), runs (113) and walks (88). Skidmore leaves as the all-time program leader in at-bats (534) and doubles (45).

Both Brennan and Skidmore were named to the Honorable Mention All-RMAC Team. For Brennan, it was the fourth consecutive season that she was named to the team.

In addition, five other Orediggers garnered all-conference honors. Sophomore utility player Katie Kocman was named to the First Team, while freshman rightfielder Jackye Lagen was an Honorable Mention pick, as well as the Co-Freshman of the Year.

Sophomore second baseman Sara Eickelman, junior shortstop Melissa Stratton and freshman centerfielder Kaleigh Starr were all named to the Honorable Mention team.



Taylor Cayou fired a perfect game against Colorado College on Feb. 25.



Seniors Beth Skidmore and Brianne Brennan won 81 games during their four years at CSM, the most by a softball senior class in school history.

## Spring Sports Wrap-Up

### Baseball

The CSM baseball team finished the 2007 season with an overall record of



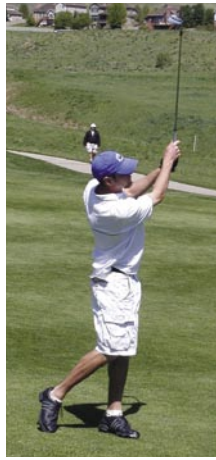
Stefan Revielle

14-38, including a 9-29 mark in the RMAC. The Orediggers concluded the season by winning two of three games against Nebraska-Kearney. Three players earned All-RMAC honors, including redshirt freshman catcher Anthony Siderius who was honored

as the Freshman of the Year. Junior Caleb Rudkin and sophomore Stefan Revielle were both named to the Honorable Mention Team. Reveille was also selected to the ESPN The Magazine Academic All-District VII Second Team.

### Golf

Senior Mark Vallee played in the 2007 NCAA Division II Northwest/West Super Regional Golf Championships at Fox Hollow Golf Course held May 7-9. Vallee fired a three day total of 220 (71-78-71) en route to a tie for fifth place. It marked the third straight year he qualified for the Super Regionals. In addition, Vallee captured the 2007 NCAA Division II Spring Regional Head-to-Head Title played at The Pinery Country Club, April 16-17. He shot a 218 total (71-73-74) and won the tournament with a birdie-eagle finish on the final two holes.



Kaity Edmiston

### Track and Field

CSM competed at the RMAC Outdoor Track and Field Championships in Alamosa, May 6-8 and both teams placed fifth. Nick Maynard was the lone CSM athlete to win a conference title as he captured the 800-meters. On the women's side, Savannah Afoa (discus), Kaity Edmiston (100 hurdles), Mellisa Rhodes (pole vault) and Gina Nichols (triple jump) all placed second in their events. CSM's men's squad finished 25th at nationals held May 24-26.

## Oredigger Overtime

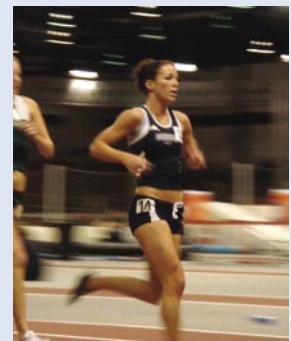


- Dan Lewis was named the head wrestling coach on April 10 after Steve Kimpel resigned the position in March. This will be Lewis' second stint as head coach of the Orediggers, as he previously held the position from 1992-2002. During that time, he coached four NCAA II National Champions, 10 All-Americans and was named the 1996 NCAA II Coach of the

Year after leading the Orediggers to a seventh place finish at the Division II national championships. Four of Lewis' teams at CSM captured the National Wrestling Coaches Association All-Academic Team Championship.

- Clint Rountree and Chad Bostwick were named assistant football coaches by Head Coach Bob Stitt on March 14. Rountree comes to CSM from The University of Tulsa, where he spent the 2006 season as a graduate assistant with the defensive backs. Bostwick comes to Golden from Maryville, MO, where he served as a graduate assistant coach for the last two years at Northwest Missouri State with the Bearcat linebackers. Over the last two years, Bostwick helped lead NWMSU to a pair of Southwest Regional Championships and two NCAA Division II National Runner-Up finishes.

- Senior indoor track and field athlete Heather Beresford was selected as the 2007 U.S. Track and Field and Cross Country Coaches Association (USTFCCCA) North Central Regional Indoor Track and Field Athlete of the Year. Beresford earned All-American honors at the Division II Indoor National Championships by placing third in the mile run (4:47.86). It marked the third straight season that she placed in the top three.



- The Colorado School of Mines baseball, softball, golf and outdoor track and field teams combined to place 31 student-athletes on the 2007 Spring Academic All-RMAC Team. To qualify for Academic All-RMAC, student-athletes must have a GPA of 3.20 or better, be a starter or key reserve, and have completed two consecutive semesters or three quarters at their current institution.

## Investing in Mines

An investment in knowledge always pays the best interest.

—Benjamin Franklin

# Petroleum Pioneer: Chuck Earlougher 1914-2007



For more than 50 years, **Robert Charles “Chuck” Earlougher** ’36 was active as an internationally recognized leader in the oil and gas industry. He passed away Jan. 17, leaving a legacy of distinguished achievements in the petroleum industry and a history of philanthropic partnership with Colorado School of Mines. He was 92.

Earlougher was a preeminent engineer, entrepreneur and advocate for his profession. A pioneer in oil recovery by water injection, Earlougher applied his expertise all over the U.S. as

well as abroad. For 35 years, he served as a consultant to the City of Long Beach, California, where his innovative work helped stop the subsidence of parts of the city caused by local oil production.

Earlougher drew great respect from his peers, for both his professional achievements and his engaging personality. Craig Van Kirk, longtime head of the Petroleum Engineering Department, knew Earlougher for almost 30 years. “When I first met Chuck, I already knew his name well because he was so remarkably accomplished and admired by those of us in industry,” Van Kirk said. “His sharp sense of humor and curiosity made Chuck fun to be around, and we enjoyed many a friendly debate.”

Earlougher was born in 1914 in Kansas, and he earned his petroleum engineering degree at Mines in 1936. He married Jeanne Storer in 1937, at which time he worked for Sloan & Zook Co. in Pennsylvania as a roustabout. Earlougher moved with his wife to Tulsa, OK, in 1938 to purchase Geologic Standards Co., which changed to Earlougher Engineering when he bought out his partner in 1945. In 1970, Stiles-Godsey Engineering Inc. bought the company, and in 1973 it became Godsey-Earlougher Inc. The company was later bought by Williams Brothers Engineering Company, for which Earlougher worked until 1988 when he reactivated and independently operated Earlougher Engineering. He was 86 before retiring completely.

In 1981, Earlougher and his wife established the Jeanne Storer and R.C. Earlougher Scholarship Fund to support non-resident Mines undergraduates majoring in petroleum engineering. As an endowment, this fund will continue to provide scholarships for promising Mines students for years to come.

Earlougher is survived by three children – Robert Charles Earlougher Jr. of Houston, Janet Hawkins of San Diego and Anne Malinowski of Morristown, NJ. His wife, Jeanne, died in 1996.

A lifelong advocate for Mines, Earlougher took pride in the School’s rigorous curriculum and high standards. He considered hard work and sacrifice to be the cornerstones of a good engineer, and his legacy of accomplishment is a testament to his personal commitment to excellence.

### Earlougher’s Awards & Recognitions

- **Mines** – Distinguished Achievement Medal – 1960
- **API Division of Production** – Citation for Service – 1964
- **SPE** – Distinguished Lecturer – 1967-1968
- **SPE** – Distinguished Service Award – 1973
- **AIME** – Anthony F. Lucas Gold Medal – 1980
- **AIME/SPE** – elected Honorary Member – Nov. 1984
- **SPE/DOE 8th Symposium on Enhanced Oil Recovery** – EOR Pioneer Award – April 1992
- **SPE** – Honorary Lifetime Member – June 1993
- **Mines** – Coolbaugh Award – 1997
- **Mines** – Century Society Member

### Clarification

The Colorado School of Mines and CSM Alumni Association Annual Report of Giving included with the winter edition of *Mines* magazine reflects gifts made to the School from July 1, 2005 through June 30, 2006 and consistently paid memberships in the Alumni Association for at least five years through June 30, 2006. Donations processed between July 1, 2006 and June 30, 2007 will be acknowledged in next year’s Annual Report. We apologize for any confusion that may have arisen regarding the dates covered by the report. Also, the Alumni Association would like to make a correction: **Paul Hodges** ’51, who has been a member of the Alumni Association for over 20 years, was incorrectly listed in the “Sustaining Members 10-14 Years” section.



# The Mines Fund Preserves Mines' Reputation for Future Generations

"By far the most important thing Mines gave us was each other," say **Jim '99** and **Louise (Jacobsen) '99 Plutt**, who met while attending Colorado School of Mines.

"But of course, Mines didn't just seal the fate of our personal lives. In our careers, our Mines educations have helped us with time management and being able to work on multiple projects with short deadlines. We also feel that our problem solving skills and ability to work in teams are much stronger than graduates from other schools."

The Plutts give to The Mines Fund because they are reminded daily of the value of their educations. And they are not the only ones: over 2,000 alumni give annually to the Fund, which received \$1.2 million in unrestricted contributions last year.



"We have always been proud to tell people we are graduates of Mines, and the only way to keep this reputation intact is to ensure that future Mines graduates are as well prepared as we were. We give to The Mines Fund to make sure current and future students have the same opportunities we had," Jim remarks.

The Fund helps preserve beloved traditions like E-Days and the M Climb, while providing unrestricted funding for academic departments and programs. "It's important that alumni support the university to maintain its great reputation in the business community," the Plutts point out. With state funding at an all-time low, these are timely words.

The Plutts also know that they once benefited from the generosity of others, and now they are in a position to reciprocate. "We hope other alumni will understand that philanthropic support helped them while they were in school, and that by supporting The Mines Fund, they can do the same for the next generation," Louise says. "We also want to help ensure that the School's reputation is maintained for our future children who might choose to carry on the Plutt tradition," she adds.

To join the Plutts in support of The Mines Fund this year, please visit <http://www.oia.mines.edu/theminesfund>.



## Noble Energy Pledges \$500,000 for Marquez Hall; Other Recent Gifts to Mines

Ted Brown,  
Noble Energy;  
Craig Van Kirk;  
Bill Scoggins

**Joseph R. Dunbar '56** added \$100,000 to the Wyoming Scholarship Fund—his third such gift to the fund.

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

**Alcoa** contributed \$35,000 to support the research of Dr. Moneesh Upmanyu.

**Bonanza Creek Oil Company, LLC** contributed \$25,000 to support the Petroleum Engineering Department.

**BP Foundation, Inc.** contributed gifts totaling \$26,600 to SUMMET (Summer Minority Engineering Training Program), the Mines Chapter of the Society of Women Engineers, the Society of Petroleum Engineers, and the Chemical Engineering, Engineering and Petroleum Engineering Departments.

Bequest distributions of \$32,488 were received from the estate of **Richard J. Carlson '69** for the Carlson Rugby Fund.

**Jim Classen '57** made a \$51,596 gift to the Geology Department in honor of his 50th Reunion.

**General Motors Corporation** contributed \$30,000 to support the Metallurgical & Materials Engineering Department.

**Infiltrator Systems, Inc.** continued their support of the research and educational activities of Dr. Robert L. Siegrist in the area of on-site and alternate wastewater technologies with recent gifts totaling \$46,000.

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

The **Mikkelsen Foundation** contributed \$30,000 to the Engineering and Applied Technology Program.

**MPRL E&P Pte. Ltd.** contributed \$30,000 to support the Petroleum Engineering Department.

**St. Mary Land & Exploration Company** contributed \$25,000 toward their endowed scholarship for petroleum engineering students.

The **Viola Vestal Coulter Foundation** contributed gifts totaling \$73,000 toward undergraduate and graduate scholarships and stipends, 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.

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

**Noble Energy, Inc.** contributed \$250,000 toward a \$500,000 pledge to support the construction of Marquez Hall, a new, state-of-the-art petroleum engineering building at Mines.

**Lonnie L. Abernethy** established a charitable gift annuity—his second—with a gift of \$100,000. The annuity residuum will be added to the Abernethy Fellowships in Ceramics.

# Mines and the “New Energy Economy”

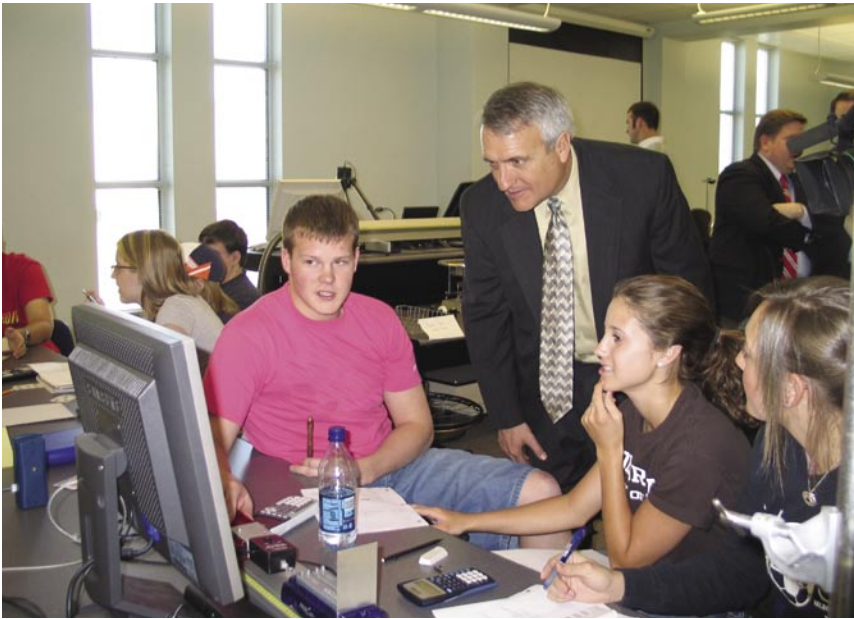
Colorado Governor Bill Ritter visited the Mines campus on March 20, one day after the signing of the Colorado Center for Biofuels and Biotechnology agreement (see story on page 22). He toured the Colorado Fuel Cell Center, a laser lab and a Physics 100 lab, and he was able to interact with students and faculty along the way. He capped off his visit by addressing a crowd of approximately 400 on Kafadar Commons. A transcript of his remarks follows.

“I want to start with thanking you all for being here. I really do appreciate the turnout.

Today I would like to talk about three things: firstly, I want to address the issue of education for the 21<sup>st</sup> century, then I'd like to speak about the energy economy and energy education, and finally I'd like to talk about Colorado School of Mines.

Let me begin by giving you a sense for the role and the place that you play in global issues around education and energy. We just had a meeting of the National Governors Association and the theme of the meeting was innovation. Because it was about innovation, it was really about education, and because it was about education, it was asking the question, “How do we educate kids to enter the workforce in a 21<sup>st</sup> century way? And not just to enter it in a 21<sup>st</sup> century way, but then to be able to compete globally in a world marketplace—in the one that will exist in 15, 20, 25 years.” The answer is that we do it by focusing on





the things that will be demanded of the workforce in the 21<sup>st</sup> century, and a big part of that will be science, technology, engineering and math. And we'll need to focus on creativity and innovation as a part of that. We're not really sure what the level of technology will be, or what will happen in high tech fields or energy production. But we know it's changing, and it's changing quickly.

The second part of the conversation concerns our ability to be a leader in a new energy economy. I call it a new energy economy because it mixes the traditional energy economy of coal, oil, gas and other minerals, with renewable energy technologies, including solar, wind, bio-fuels and fuel cells. We need to look at ways renewables, in conjunction with the traditional energy economy, can get us to a place of energy independence in this country. In his last two State of the Union messages, the president has talked about this. And as a governor who has paid attention to this issue at the national and the state levels, I believe our ability to gain energy independence rests on states having energy policies that really examine the role renewables can play in traditional energy economies. "How do we ensure that we mine traditional energy resources in a very significant way without undermining our environment? How do we burn coal more cleanly? What role can coal gasification play in that?" Those kinds of questions are all on the table as we go forward, and as a state we can play a leadership role. And let me tell you *why* I think it's important. It's important because it's an issue of national security and economic security for the United States of America. And as a state, we can be a leader in this arena. We can help forge an energy economy that uses improvements in technology to produce energy from traditional sources, the non-renewables, and at the same time look at renewables, and then we say, "Okay, what's the mixture going forward—how can we get to energy independence?"

When you take those two concepts, they come together in a very big way at Colorado School of Mines. So for the people who are professors here, for the people who are administrators and for the students, you are at the vortex of what I believe is the future of this country in terms of developing energy policy, energy research and an energy economy because you combine research on that which I think is fundamental to our ability to have national security 25 or 30 years from now.

I just want to congratulate you on the work you're doing. We're working very hard to ensure that, in this state, we pay attention to this issue. We've talked about the new energy economy in Colorado and our leadership role. We formed the Renewable Energy Collaboratory last year with Colorado School of Mines, Colorado State University, the University of Colorado at Boulder and the National Renewable Energy Laboratory. We just announced yesterday yet another public/private partnership, Colorado Center for Biofuels and Biorefining, as a part of the Collaboratory that combines the efforts of the public sector and some very big players in the private sector. We're going to keep emphasizing this new energy economy. We're going to emphasize it for economic development reasons, for environmental reasons and just because we believe it is the future of this country.

So we'll pay attention to energy policy and make sure that it is research and data driven. And we'll make sure we are educating students so they can enter the workforce in a 21<sup>st</sup> century way. Thank you for the chance to be here today. Thank you for being students here, for working on your degrees in a way that's going to be meaningful to us in the future. Thanks especially to the faculty, to the administrators and all the people who've been a part of making the School of Mines the school that it is—one of the best in the world around the educational programs it offers. ”

—Governor Bill Ritter

# Energy and the Curse of Interesting Times

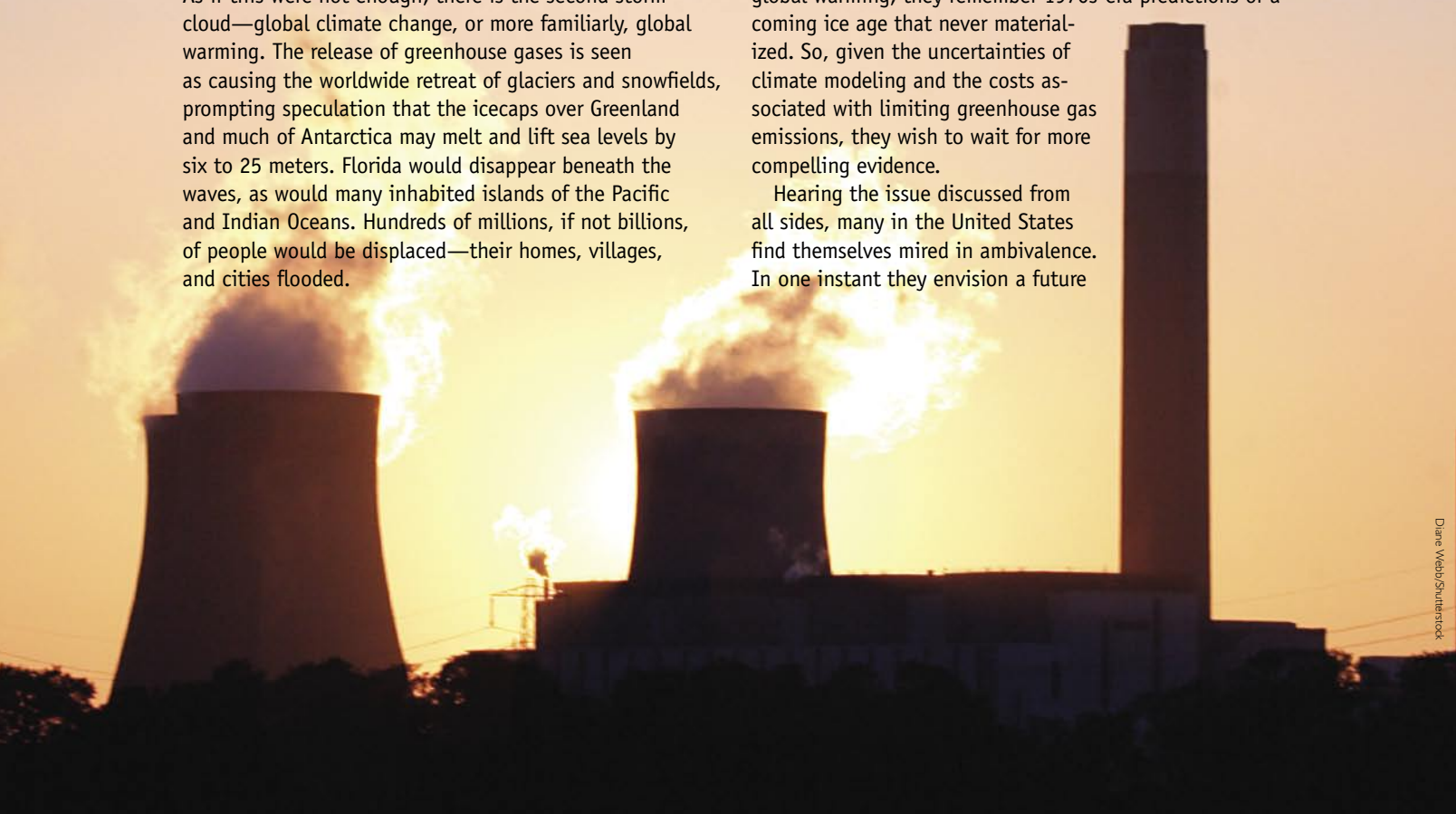
by Mark Eberhart

**R**eputedly, an ancient Chinese curse says, “May he live in interesting times.” Like it or not, for those working in energy related fields, times are interesting. We find ourselves at the center of a growing debate pitting the economics of energy against our desire to act as good stewards of the earth.

On one side of this controversy are those who see dark clouds on the energy horizon. For them, the dual thunderheads of threatened oil supplies and global climate change cast a pall over the future. Many believe the tempest is already upon us. The surge in oil costs is blamed on global demand surpassing supply. From now on, the thinking goes, it is all downhill for production and uphill for prices. As if this were not enough, there is the second storm cloud—global climate change, or more familiarly, global warming. The release of greenhouse gases is seen as causing the worldwide retreat of glaciers and snowfields, prompting speculation that the icecaps over Greenland and much of Antarctica may melt and lift sea levels by six to 25 meters. Florida would disappear beneath the waves, as would many inhabited islands of the Pacific and Indian Oceans. Hundreds of millions, if not billions, of people would be displaced—their homes, villages, and cities flooded.

On the other side of the argument are those who feel that such catastrophic predictions are overblown. These people look to history and note that there has never been a time without doomsday scenarios and impending shortages. They believe continued exploration, advancing technology and the exploitation of unconventional petroleum resources will offset diminishing energy supplies. As for global warming, they remember 1970s-era predictions of a coming ice age that never materialized. So, given the uncertainties of climate modeling and the costs associated with limiting greenhouse gas emissions, they wish to wait for more compelling evidence.

Hearing the issue discussed from all sides, many in the United States find themselves mired in ambivalence. In one instant they envision a future



where energy is no longer plentiful; a future where the atmosphere has warmed, creating widespread drought; a future where the ice caps have melted and coastal cities are flooded. The image is a disturbing one, and many are motivated to take action—to stop burning fossil fuels and outlaw gas guzzling cars. In the next instant, the uncertainties and costs associated with relinquishing energy seem too great. For while other species use energy to feed their bodies, for us the greatest part of energy consumption goes to nourish our imaginations. All that we are, all that we hope to be, requires energy. We are not junkies “hooked on energy.” We are creative beings, reliant on energy to give substance to the things we imagine. So under the harsh prospect that such creativity and imagination might starve, the resolve of the instant before withers. In such doubt and uncertainty, the ambivalent among us look for guidance and reassurance. Some look to Mines for the expertise to resolve these issues. What advice should be given?

While pondering this question, it is worth remembering that this is not the first time humankind has confronted an energy dilemma. Energy shortage is apparently part and parcel of cultural development. Some societies do not survive their brush with scarcity; others do. The Maya, Anasazi and Easter Islanders used their energy resources to sustain complex cultures distinguished by magnificent art and architecture. When their energy resources were exhausted, these civilizations vanished, leaving behind only buildings and monuments to mark their passing.

The cultures of medieval Europe were more fortunate. On the eve of the industrial revolution, the prime energy source of the time was under threat. Great parts of the European continent had been logged for arable land, timber and energy. Much as today, governments recognized the impending crisis but were up against their own insatiable appetites for navies and iron weapons to guarantee national security. The citizenry required steel tools, timber, glass, lime and bricks for buildings, and creature comforts like home heating fuel, beer and distilled spirits. For these, and other things, the clearing of timberland for energy could not be halted, or even slowed. Eventually, coal was forced on a deforested Europe as the fuel of last resort.

Even as the forests of Europe fell to the woodsman’s ax, a great debate raged among the most acclaimed scientists of the day—Newton, Descartes and Leibniz—as to exactly what energy was. They called it “the living force.” But when it came to quantifying it, or measuring it, they were clueless. No one of the period recognized that work and heat are simply forms of energy, or that work can be converted entirely to heat—though heat cannot be converted wholly into work. Thanks to scientists, philosophers and engineers of the 17th, 18th and 19th centuries, all of this is now common knowledge. We know the maximum work that can be extracted from heat, and how to build machines that operate near this optimum efficiency. We know how to store and liberate the energy of chemical reactions, and how to harvest the energy held captive inside the nuclei of atoms. We know how to convert sunlight, wind and waves into electricity, and transmit it over vast distances. We know how to turn coal into a liquid to fuel our cars. We know of vast supplies


of “pre-oil” locked in rock and how to process it into the real thing. We are now alert to many of the environmental pollutants generated through unrestrained energy use, and have developed technologies to scrub combustion gases free of these harmful contaminants. We know that the accumulation of atmospheric carbon dioxide intensifies global warming, and we have developed and are developing technologies to sequester the gas.

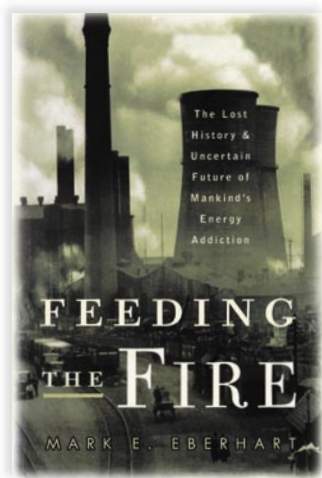
Whereas the people of medieval Europe had to settle for the energy future given them by happenstance and necessity, today the world possesses the knowledge and technology to design the future. This is the message that scientists and engineers have to offer: The experience of thousands of years has been turned into knowledge, and with it, we can shape a new world where we must neither deprive ourselves nor threaten the earth.

This optimistic, “technology will win out,” view of the future is not that of the majority. For many, technology is seen as the cause, not the cure, for our energy ills. Changing a worldview will not be easy. The effort will demand a state of mind characterized by a temperament of the will, imagination, courage and, above all else, an appetite for change. These are the qualities of youth, and thus, it is young people from Mines and our sister institutions around the world who must take the lead. They, and their young colleagues everywhere have had thrust upon them a great burden of responsibility.

The Italian philosopher Niccolò Machiavelli said, “There is nothing more difficult to take in hand, more perilous to conduct, or more uncertain in its success than to take the lead in the introduction of a new order of things.” This task falls to this generation’s scientists and engineers.

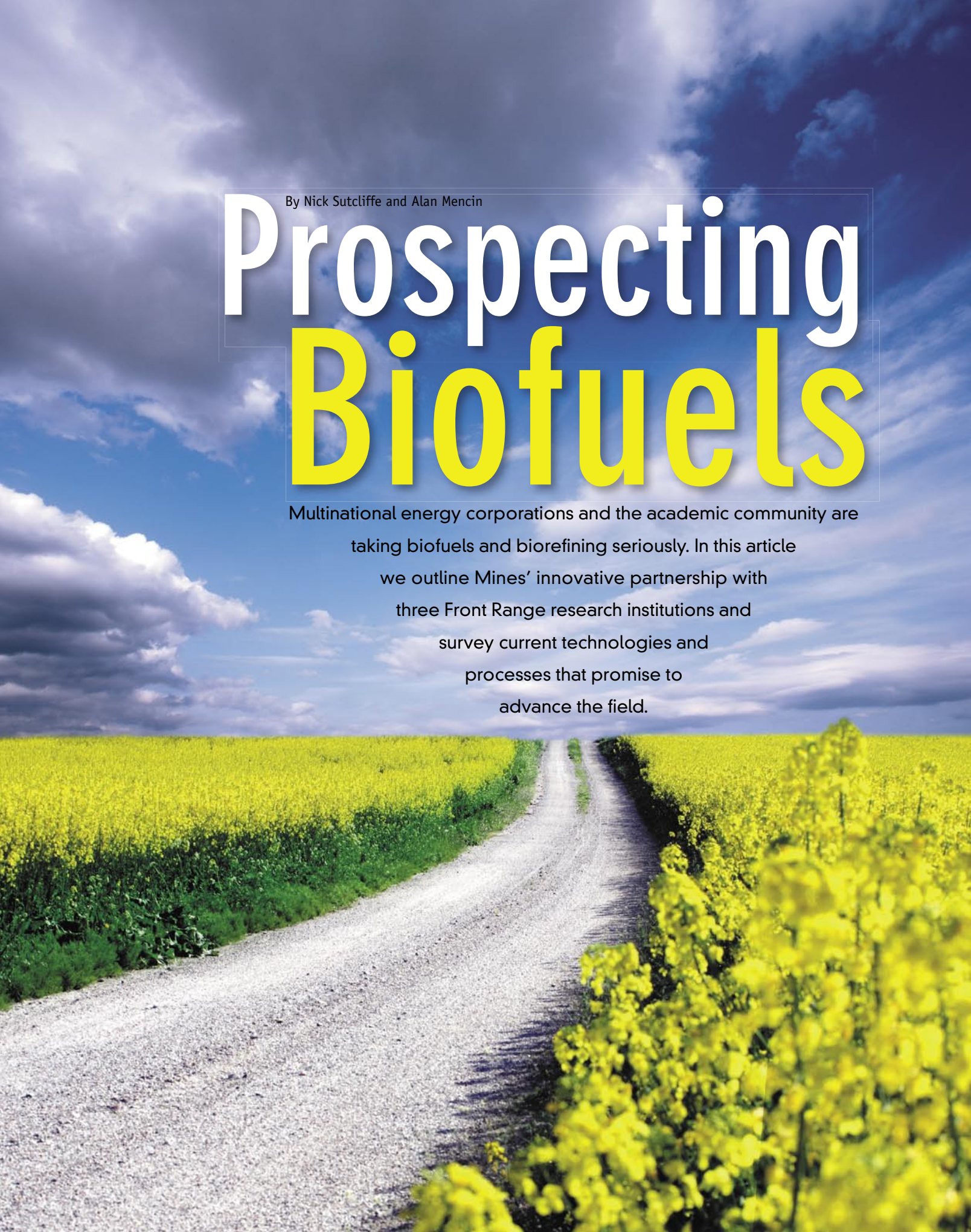
As Robert Kennedy observed in his “Day of Affirmation Address,” when it comes to setting the world upon a different course, the road ahead will be littered with barriers. First is the barrier of futility: in this case, the belief that the array of obstacles blocking the path to a secure and sustainable energy future are too numerous and too monumental to surmount. The second barrier is that of expediency: the belief that optimism and convictions must yield in the face of practicality. The third barrier is comfort: the temptation to abandon the race to claim financial success dangled before those who have the privilege of education. But to be stopped by any of these barriers is to suffer the curse of interesting times.

The force that will lift us over all these barriers is imagination and commitment. The hard-won knowledge of a hundred generations can be used to inspire. More than at any other period in history, the knowledge and expertise of engineers and scientists will be needed to see us through these interesting times. In due course, we at Mines will judge ourselves by our contributions in building a new world where safe and clean energy is plentiful and available to all. 



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*Mark Eberhart is a professor of chemistry and geochemistry and teaches in the Materials Science Program at Mines. His first book, Why Things Break, recounts the development of the new field of fracture as chemistry. His second book, titled Feeding the Fire, explores man's relationship with energy and was released this May.*



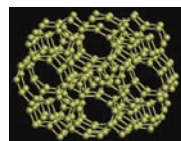
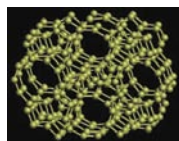
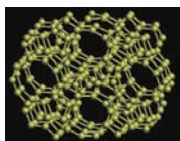
By Nick Sutcliffe and Alan Mencin

# Prospecting Biofuels

Multinational energy corporations and the academic community are taking biofuels and biorefining seriously. In this article we outline Mines' innovative partnership with three Front Range research institutions and survey current technologies and processes that promise to advance the field.

If you heat wood to approximately 500 degrees Celsius in the absence of oxygen, you get pyrolysis oil—a flammable liquid that can be used to make liquid fuels or a variety of chemicals. If you heat wood to greater than 700° and include a small amount of oxygen and steam, you get synthesis gas, or syngas, which, among other things, will run a combustion engine, generate electricity, or yield a variety of liquid fuels. All this from wood—or switchgrass, or straw, or just about any dried cellulosic biomass. And there are many other ways to convert biomass to useable forms of energy.

However, despite such potential, much of the science surrounding biofuels is poorly understood, and most technologies for industrial-scale production are in their infancy. To help advance understanding, Colorado School of Mines has entered into a partnership with three Front Range research institutions and several private corporations to form the Colorado Center for Biorefining and Biofuels, also known as C2B2. The collaboration includes the University of Colorado at Boulder (CU); Colorado State University (CSU); the National Renewable Energy Laboratory (NREL); Mines; and more than 10 private corporations including Chevron, ConocoPhillips, Dow Chemical and Shell Global Solutions.



Interest in industrial-scale production of biofuels has been growing for some time, driven by various arguments from diverse political and ideological points of view. For example, many believe that reducing the country's dependence on foreign oil increases national security. Others point out that the diminished use of fossil fuels will slow the accumulation of greenhouse gases in the atmosphere. And still others point to the economic boost biofuels would give to American agriculture.

To explore how much energy America could generate from domestically produced biomass, the U.S. Department of Energy and the Department

of Agriculture completed a joint research project in 2005 known as the "Billion Ton Study." They concluded that by making relatively moderate changes to agricultural and forestry practices, the U.S. could sustainably provide sufficient biomass for one-third of its transportation fuel needs using existing conversion technologies.

While the potential is evident on paper, if the U.S. is going to get anywhere near such a lofty goal in practice, the science must be better understood and complex new systems engineered. Therein lies the mission of C2B2, which is the first major initiative of the recently established



Corn-based ethanol production plant in the Dakotas.

Colorado Renewable Energy Collaboratory signed in Feb. (see story p. 6).

Chemical Engineering Professor John Dorgan, who is the C2B2 site director for the Mines campus, points out that there are three primary pathways—biochemical, chemical and thermochemical—for converting biomass into electrical power or useable fuels. The biochemical platform, currently the most widespread, involves breaking biomass down into simple sugars that can be fermented into ethanol. An example of chemical conversion is biodiesel, which involves growing crops rich in triglycerides (such as soybeans), extracting their oils and chemically converting them into liquid fuel. There are a variety of thermochemical conversion methods, most of which involve heating biomass to produce either syngas or pyrolysis oil.

### Biochemical Conversion

By far the most popular biofuel in the U.S. is ethanol, and production has skyrocketed in recent years. At current rates, we'll produce in excess of 5 billion gallons during 2007, up from 3.7 billion gallons in 2005. Almost all of this is produced through the biochemical conversion of sugars, with starch from corn grain serving as the primary feedstock.

Corn is a particularly convenient feedstock because it is so easily broken down into fermentable sugars such as glucose. Under the right conditions, glucose is metabolized by specific microbes, commonly called yeast, to produce ethanol. When ethanol concentrations reach about 14 percent by volume, the microbes die and the fermentation liquid, or "beer," is distilled to obtain pure ethanol.

Although this approach is successfully yielding large quantities of ethanol, it is expensive and the industry is propped up by a 51-cents-per-gallon subsidy. The use of corn grain as the feedstock inflates the price considerably, and switching to a production pro-

cess that utilizes cellulosic feedstocks (for example, wood, grasses and corn stover) is viewed by many as the key to lower costs.

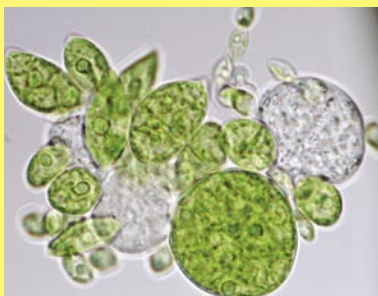
Cellulose, the most abundant organic compound on earth, is a complex polysaccharide composed entirely of glucose. However, unlike starch, it is hard to break down. A triumph of evolutionary design, it is the biological equivalent of armor plate and has become the fundamental building block of the plant kingdom. In searching for a chink in the armor that would allow cellulose to be easily and inexpensively hydrolyzed into simple sugars, researchers have developed an innovative new process.

This approach employs heat, sulphuric acid and enzymes to convert cellulose into its constituent sugars, and it is expected to be economically feasible in the not-too-distant future.

Fermentation has some similarly promising technologies on the horizon. Along with glucose, hydrolysis of cellulosic feedstocks yields additional five- and six-carbon sugars which cannot be fermented into ethanol by naturally occurring yeast. Genetically engineered yeasts are currently available that can metabolize these sugars, thereby increasing the efficiency of the overall conversion process, but their use is not yet cost competitive.

### Chemical Conversion

Ethanol is only one of several biofuels the energy industry is taking seriously—another is biodiesel. Made from vegetable oil, this organic liquid fuel can be manufactured at room temperature using a rather simple chemical conversion process. In the presence of a catalyst and an alcohol, the triglyceride (fat) molecule is converted into fatty acid esters and glycerin. Once the glycerin has been removed, the resulting fatty acid esters provide an adequate substitute for petroleum-based diesel in almost every application. The drawback is cost: Production is expensive and the industry's



### Green Algae and the Hydrogen Economy

**In recent years, national attention has been drawn to hydrogen gas as a clean alternative to fossil fuels. However, industrial-scale hydrogen production uses fossil fuels. Looking into an alternative means of production, Mines graduate student Jonathan Meuser, along with faculty members John R. Spear and Matthew Posewitz are researching certain hydrogen-metabolizing algae. Using the enzyme hydrogenase, many bacteria can utilize hydrogen as an energy source. In green algae, these enzymes can be used to make hydrogen from sunlight and water. Understanding and optimizing these enzymes in biological systems could pave the way toward a truly sustainable hydrogen economy.**



growth is currently supported with subsidies ranging from 50 cents to \$1 per gallon.

A more economical feedstock would reduce prices, and one promising alternative is oil from algae, which can be produced much more intensively than traditional crops. While soybeans typically yield about 48 gallons of oil per acre annually, algae, grown in carefully monitored shallow, open ponds or clear plastic tubes, have the longer term potential of producing yields upwards of 10,000 gallons of oil per acre. Although the process is capital intensive and requires large quantities of water, carbon dioxide and nutrients, its potential has captured the interest of capital investment markets and the energy industry.

A synthetic diesel fuel can also be made by introducing heated animal or vegetable oils into a hydrogen-rich environment in the presence of a catalyst. Called renewable or “green” diesel, it is nearly indistinguishable from the petroleum-based product and is the focus of a recently announced joint venture between ConocoPhillips and Tyson Foods.

## Thermochemical Conversion

Turning biomass into a useable fuel source via a thermochemical conversion process can take a variety of paths, all of which involve heating biomass in either low- or no-oxygen environments.

When cellulosic biomass is heated in the absence of oxygen (a process known as fast pyrolysis), the main product is bio-oil, which can be burned as a substitute for petroleum-based fuel oil in boilers. Alternatively, when cellulosic biomass is heated with a limited amount of oxygen and steam (a process known as gasification), the main product is synthesis gas, or syngas. Among other uses, this flammable combination of carbon monoxide and hydrogen can be burned in a turbine, fed into a solid oxide fuel cell to produce electricity, or converted into a variety of liquid fuels using Fisher-Tropsch processes.

Before these processes can be applied on a commercial scale, however, numerous problems must be solved and the chemistry better understood. Syngas made from biomass contains ash and tars, which can damage turbines and degrade catalysts in solid oxide fuel cells. Understanding how to deliver a clean supply-stream of biomass-produced syngas has researchers busy around the world, including Professor Andy Herring, in the Chemical Engineering Department. Understanding how to engineer solid


oxide fuel cells so they tolerate supply streams of unscrubbed syngas is a research focus of Tony Dean, the William K. Coors Distinguished Professor in Chemical Engineering.

## The C2B2 Partnership

C2B2 brings together four diverse research institutions that encompass the full spectrum of biofuel- and biorefining-relevant expertise: CSU has world-class capabilities in the agricultural sciences, as well as the internationally recognized Engines and Energy Conversions Laboratory; CU-Boulder is well known for its expertise in biological and chemical engineering, molecular and cellular biology, and biochemistry; NREL has highly specialized laboratory facilities and decades of experience researching biomass energy conversion technologies; and Mines brings a wealth of knowledge in refining, chemical engineering, materials engineering and fuel cell technologies.

The goal of C2B2 is to develop new technologies and advance them into the private sector as quickly as possible. Companies participate in C2B2 with payment of a membership fee that funds shared research initiatives. In so doing, they gain access to this rich pool of expertise, as well as the research and development resources of sponsoring industrial partners.

The partnership has received strong political support at the state level. The formation of the Renewable Energy Collaboratory can be traced back to the 2006 Renewable Energy Summit sponsored by Sen. Ken Salazar’s office. His staff has remained actively involved by facilitating negotiations and helping to frame the final C2B2 agreement. After campaigning on a strong renewable energy platform, Gov. Bill Ritter has embraced C2B2. And on the Mines campus, President Bill Scoggins is enthusiastic, seeing it as “substantive and timely progress toward finding solutions to [our energy] challenges.” On the front lines of C2B2 research, Tony Dean is particularly upbeat about the School’s role: “We are a key player on a big-league team. We’ve got a lot to offer and we have a lot to gain in terms of sharing knowledge and sharing facilities. Having NREL so close is a major advantage.”

With the partnership barely two months old, it’s impossible to predict where C2B2 will lead, but with four multinational corporations on board, exceptional research capacity at hand and worldwide interest in biofuels at an all-time high, the future looks bright. 



### Materials from Biomass

**While energy from biomass is the main focus of C2B2, materials shouldn’t be ignored. John Dorgan, professor of chemical engineering, points out that bioengineering and biorefining can yield many of the materials traditionally produced from petroleum. Illustrating the point, he explains how switchgrass can be genetically modified to synthesize and store polyester. When harvested, cellulose from the plant can be used as feedstock for ethanol production and the polymer extracted to provide a valuable co-product.**

This spring, a team of second-year EPICS (Engineering Practices Introductory Course Sequence) students took on more than an academic challenge: They were asked to devise a simple sustainable water-purification system for villagers in the remote provinces of Central Asia. EPICS courses routinely ask undergraduates to solve real-world engineering problems—in this case, meeting a basic need for people living in such severe poverty provided additional motivation.

Courses in EPICS divide students into teams. Each team functions as a de facto engineering firm, ushering a project through the conception, assessment, economic evaluation and construction phases. Two EPICS courses are mandatory for all Mines students—EPICS 151, the freshman-level course, and EPICS 251, intended for sophomores.

“The practice that a student gets in EPICS classes dealing with real clients and great teammates is important,” says sophomore Garrett Waltsak. “I never realized that I needed to practice working with others and letting my own agenda go. Now I know that I need to learn more before I can reach my full potential, so I’m glad I’ve got a running start.”

Waltsak was one of two EPICS teams to work on the water-purification project. The idea came from Mines alumnus **Bob Hedlund** ’75, who has spent most of the last decade in Uzbekistan as the head of Joint Development Associates International (JDA), a humanitarian-aid organization that promotes infrastructure development. Hedlund wanted a system that could purify 100 gallons of water a day and could be built with materials readily available to Uzbek villagers.

The challenge immediately appealed to EPICS department chair, **Robert Knecht** ’70, MSc ’75, PhD ’79. While he takes on projects from clients as diverse as private-sector manufacturers, scientific research labs and government agencies, Knecht has a particular fondness for assignments in faraway places. One EPICS class de-

signed flood-resistant housing for a Vietnamese village. Another came up with ways to generate electricity for an Alaskan vacation resort. And every summer, Knecht leads a team of students to St. Kitt’s, a Caribbean island nation. Over the years they have devised a water-treatment system for the state hospital, a sewage channel for the penitentiary, soil erosion-control programs, hiking trails and other amenities.

“EPICS gives the students a feel for what it’s really going to be like when they get out into the workforce,” says Knecht. “Working on teams is almost a given for any company they go to work for. We give them some practice working with others and some training and procedures to help them when they run into problems working in groups.”

Knecht presented Hedlund’s project to an EPICS 151 class in the spring of 2006. In the spring of 2007, the EPICS 251 team revisited the assignment and refined some of the ideas that had been developed the preceding year.

The final design falls into the category of solar water disinfection,

# EPICS Team Tackles Clean Water Challenge

By Larry Borowsky



or SODIS. This sustainable, affordable technology has saved thousands of lives among populations that lack a safe, reliable water supply. The students devised a system that relies on gravity to take water in—that is, the device must be positioned on a slope near a natural stream. Water flows into the unit, and bottlenecks back up in a series of collection chambers.

Tin-foil solar traps and Fresnel lenses focus the sun's rays on the collection chambers, producing the heat that purifies the water.

"They figured out that putting some dams in there to stop the water would increase the holding and heating time," says Knecht. "That's a great observation for second-year students."

"The water must remain at 50 degrees Celsius for at least one hour in order to kill biological pathogens such as viruses, spores, cysts and worm eggs, chloroform and other bacteria colonies," explains Waltsak. "A temperature logger takes readings every few minutes. If we want to be extremely accurate, we can use an Adenosine Triphosphate (ATP) bioindicator." (A device that tests for the pres-



Bob Hedlund, '75 discusses options with students.


ence of ATP, a universal energy-transferring molecule present in all living organisms.)

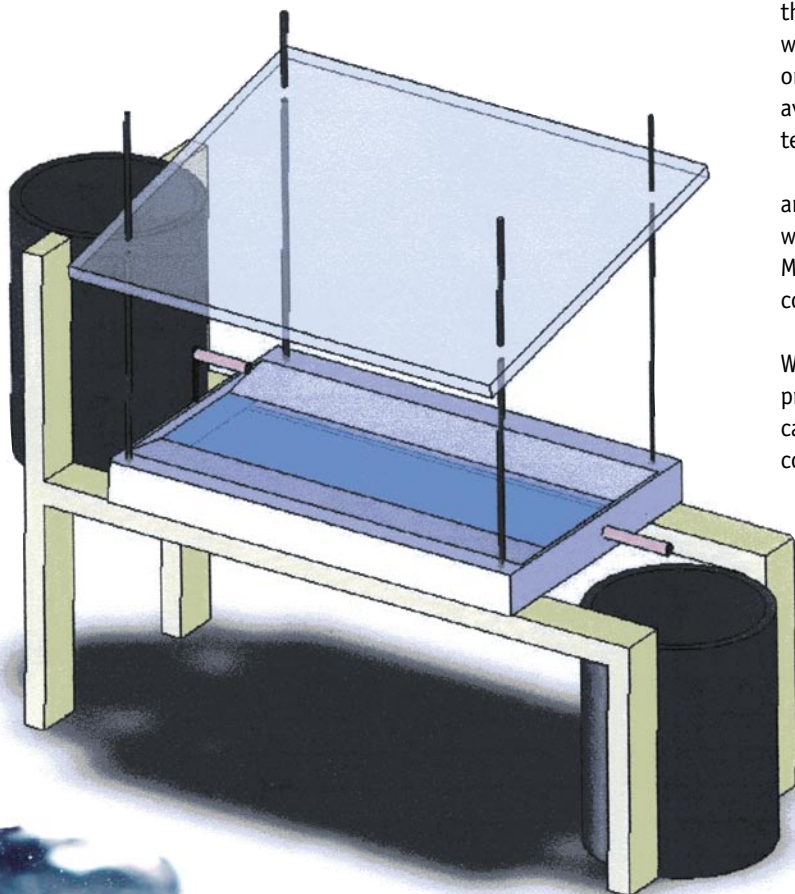
Coaching students to develop their communication skills is a core component of EPICS, which makes Hedlund's SODIS project particularly appropriate. "They're going to be working with a team in another part of the world, so they'll need to provide good graphics and written instructions on how to build this thing and how to run it. They're likely to be dealing with people who are not as technically skilled," says Knecht.

The EPICS 251 team tinkered around with a design that incorporated a solar-powered pump to propel water through the SODIS device. That way, the unit could be deployed on any terrain, rather than requiring a slope to draw in water. Designing a pump that worked wasn't a problem, but the students were unable to design one that was affordable and could be built using materials readily available in remote Central Asian provinces. Ultimately, the EPICS team abandoned that quest and stuck with the gravity-fed design.

They tested the SODIS unit on Clear Creek water, sending before-and-after samples to one of Mines' environmental labs. The tests were encouraging enough that Knecht entered the design in the Mondialogo competition, a UNESCO-sponsored international design contest, which has yet to be judged.

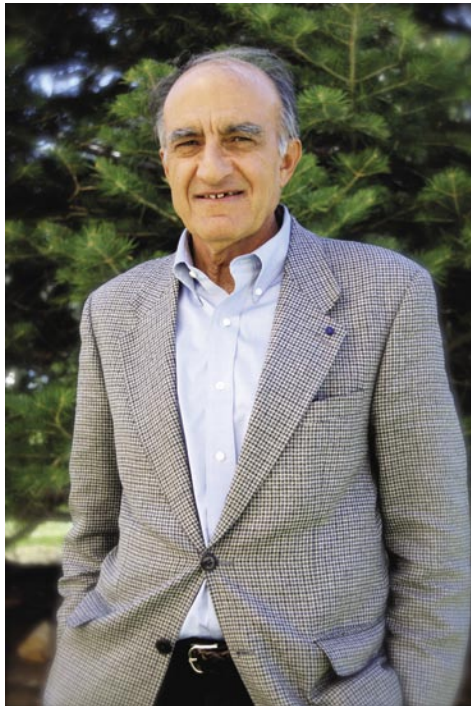
"Working out a good design process is never easy," says Philip Wolfram, a member of the EPICS 151 team that tackled the SODIS project in the spring of 2006. "We learned the importance of critically evaluating all ideas, no matter how far-fetched or crazy, since considering all ideas and distilling their most salient elements enabled us to work together without conflict. We fought to ensure that only the best ideas were incorporated into our design. Will our design be able to provide larger-scale water purification for developing countries? We hope so."

And it may. Knecht is currently working with a team of students at the University of Kabul who plan to use the teams' design specifications to build a purification system this fall. Depending on how it performs, Hedlund may see the product through to production. 



# A Brief Conversation

## Chesebro' Distinguished Chair in Petroleum Engineering



**D**uring his 40 years of experience in industry and academia, Hossein Kazemi's research has yielded major improvements in oil and gas production from naturally fractured reservoirs. His accomplishments earned him the appointment as Mines' Chesebro' Chair in Petroleum Engineering in 2006. Dr. Kazemi is a member of the National Academy of Engineering, an Honorary Member of the American Institute of Mining, Metallurgical and Petroleum Engineers (AIME) and a Distinguished Member of the Society of Petroleum Engineers (SPE). His other honors include the 2006 IOR Pioneer Award, 1995 Everett Lee DeGolyer Medal, 1987 John Franklin Carll Award, 1991 SPE Distinguished Service Award and the 1980 Henry Mattson Technical Service Award.

The Chesebro' Distinguished Chair in Petroleum Engineering was established in 2003 through a gift from **Steve '64** and Dollie **Chesebro'** and was the first endowed faculty position for the Department of Petroleum Engineering.

In between Kazemi's teaching and research endeavors, *Mines* magazine had the opportunity to chat with him.

**Mines:** What brought you to a career in petroleum engineering?

**Kazemi:** As a high school student, I developed a great attachment to applied science and mathematics, which led me to petroleum engineering. The research opportunities I received in graduate school at the University of Texas at Austin helped me to launch my research career, and upon graduation in 1963, I was presented with offers from several oil company research centers to pursue my dream of conducting scientific research. I spent five years with Sinclair Research in Tulsa, where I built the foundation of my future career path by solving field problems through scientific research. I later joined Marathon Oil Technology Center, in Littleton, as a research scientist, where I eventually headed the production research and reservoir management technology departments. There we had the equipment and the brainpower to investigate and solve a broad range of industry problems. The proximity of the Marathon Center to Mines provided me with a unique opportunity to become closely associated with the School, first as an adjunct professor and researcher, and now as Chesebro' Chair.

**Mines:** In what ways is your work focused on the challenges that the oil and gas industry will face over the next several decades?

**Kazemi:** I focus on finding ways to produce oil and gas more efficiently from conventional and unconventional reservoirs—especially, oil. At the moment, we produce, on average, about 30 to 35 percent of the oil in conventional reservoirs. Increasing production from existing fields by just 5 percent would yield an additional 100 to 150 billion barrels of oil. As for the future, the problems will be tougher because we will be dealing with harsher deep water environments and unconventional oil and gas resources. In addition, the bulk

# with Hossein Kazemi

of the world's oil reserves in the Middle East are in carbonate rocks. These rocks are often extensively fractured, which causes additional difficulties for producing oil.

I have spent much of my professional career analyzing fluid flow in these reservoirs to find ways to improve oil recovery. Early in my career I developed a numerical single-phase flow model and a water-oil flow model for naturally fractured reservoirs. The latter model was extended to include water-oil-gas flow and multi-component flow. These models have been debated in reservoir engineering circles and, as result, have led to a better understanding of the capillary-gravity oil drainage mechanism from the rock matrix in fractured rocks. Over the last 20 years, I extended numerical modeling of naturally fractured reservoirs to deciphering the mechanism of the enhanced oil recovery by surface active agents (both wettability altering and interfacial tension lowering chemicals). Most recently, I have been focusing on dilation of natural fractures to enhance oil and gas recovery from fractured shale and their impact on low-permeability gas reservoirs.

The teams of engineers and geoscientists I worked with during my 20 years as a research manager at Marathon Oil made critical advancements in technology for the industry. Our collaborative results were a great success in terms of scientific contributions, technical service and technology transfer.

**Mines:** What do you anticipate will be the next big breakthrough in oil recovery?

**Kazemi:** This is a very difficult thing to predict, but I believe in the U.S. we will develop more efficient and comparatively cheaper techniques for recovering hydrocarbons from unconventional resources, and globally there will be

massive resurgence of enhanced oil recovery by steam, miscible  $CO_2$  gas, hydrocarbon gas and micellar solutions. I also believe we will focus a lot of effort on environmental issues such as  $CO_2$  sequestration, water disposal and reduction of hydrocarbon and other undesirable gas emissions into the atmosphere.

**Mines:** What qualities are important for success in petroleum engineering today—beyond a sound grasp of the required technical knowledge?

**Kazemi:** Business ethics are particularly critical today. I do not find any personal happiness without moral and ethical integrity in my own day-to-day conduct, which translates to the business world as well. I teach students to use science as an instrument of good. I strive to help my students realize that a major mission of a great university, such as Mines, is to develop men and women guided by the highest ethical standards as a rule of life.

I also believe it is important to emphasize collaboration and teamwork among the bright minds from many countries that come to study at Mines. In recent years, as I have spent more time on the campus, I have observed great camaraderie among my graduate students irrespective of their country of origin—just as you would wish it for the world community at large.

As for the future, Mines needs petroleum engineering students who can relate to physical sciences better. Our students must be willing to get back into the laboratory to design and conduct relevant experiments, go to the computer lab to write mathematical models and continue Mines' reputation and tradition of solving field problems in the business world.

**Mines:** You have been associated with Mines and involved in research for the

oil and gas industry for many years—how has your appointment as the Chesebro' Distinguished Chair influenced your work?

**Kazemi:** It has given me an added dimension of recognition and a vote of confidence to push forward the frontiers of research. My research is more focused and productive, because I am less influenced by government and industry funding trends. I am also able to attend more conferences—that kind of exchange of information is good for my research work, the department and the School. It fosters collaboration and helps to attract more funding and higher caliber students to Mines.

**Mines:** What do you consider to be your greatest professional achievement?

**Kazemi:** My peers are the right judge for this—not me. However, I was fortunate to work simultaneously in industry and academia, as a bridge between the two worlds.

As for technology, while I have worked on many problems, I developed a very good understanding of flow of multi-phase fluids and their interaction in naturally fractured reservoirs, which constitutes about half of the petroleum reservoirs worldwide. This understanding continues to be very crucial for the industry when planning for improved and enhanced oil recovery applications in such reservoirs.

**Mines:** On a lighter note, how would you describe your ideal weekend?

**Kazemi:** It follows a successful week with my students in the classroom or labs, and a productive week with my colleagues. With the resulting sense of accomplishment, I am able to fully enjoy a jog in the sunshine, coach a youth soccer team, enjoy a delicious meal with my family and perhaps watch a sports event. 📧

# The Network



## Ski Team Reunites After 29 Years

Members of the 1974-1978 CSM ski team were reunited on Feb. 23, 2007, in Whistler, British Columbia. Three days of skiing and trips down memory lane rounded out a fantastic time together. **Miles Barrett** '78, **Murph Hannon** '78, **Tim Stouffer** '78 and **Rick Williams** '78 traveled from Louisiana, Alberta, Texas and Massachusetts, respectively, for the much-anticipated gathering. While maintaining contact over the years, all four had not been together since graduating. "Because the ski team, sponsored by Dr. Bob Witters

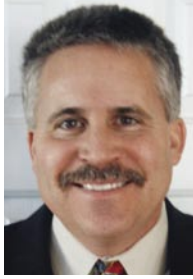
(Chemistry), was the introductory factor at school, having a team reunion seemed a natural choice," wrote Stouffer. The snow cooperated rather spectacularly, and the four spent each day proving to the others that they could still ski like 20 year olds, no matter how much graying or hair loss had occurred in the meantime. In fact, each could pick the others out of crowds of skiers because their skiing style was the same as in years past. Unanimous agreement was reached that the next gathering would be sooner than 29 years!

## Life Members

The Alumni Association gratefully acknowledges its new Life Members welcomed between Oct. 10, 2006 and May 20, 2007.

Daniel G. Anderson '85	Dale R. Loveland, Jr. '90
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David W. Baker '80	Aaron M. Martinsen '99
Mark E. Bush '82	David F. Mayer '80
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David D. Ciemnoczowski '96	Catherine A. Mencin '83
Erin K. Conlon '91	T. Gregory Merrion '80
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D. Wilson Culp '99	Com Mark J. Oberley '89
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Jody E. Kamrath '88	Jean R. Wilson '86
Kirk L. Ketcherside '85	Ryan E. Zorn '96
Eric T. Kingham '98	
Phillip A. Kriz '83	

*The fee for Life Membership to the Alumni Association is \$1,000, payable over five years if preferred.*



# The Career Column

By Richard Hewitt '82, MSc '89, MSc, PhD '92

## The Only Reason Anyone Will Ever Hire You

Over the years, I've made an observation that still amazes me. No one, and I mean no one, knows why they've been hired for any job they've ever had. I've talked to CEOs and entry-level managers, career coaches, professional recruiters and even HR executives and no one has a clue.

Oh, they all think they know. They tell me they were hired because they had the right background; meaning they went to the right school or they earned the right grades.

Some tell me they had the right experience; meaning they've been doing geology in the gulf coast for 20 years and the company that hired them was looking for someone with exactly that experience.

Others tell me that when it came to the interview, they really connected with the interviewer and they didn't embarrass themselves. I call this the cultural fit. Cultural fit means that if you interviewed over lunch, you didn't spill soup on yourself and you knew which fork to use for your salad.

Everyone tells me they got hired for one of those three reasons: they had the right background, the right experience, or they were the right cultural fit.

And I tell them (politely) that they haven't got a clue. Then I tell them that there's only one reason anyone has ever been hired, in any industry, at any point in history: a decision maker had a problem they thought the job seeker could solve, and the job seeker cost less than the problem did.

It's pretty simple, but not so obvious until it's laid out that

way. Unless you meet all four conditions—#1 decision maker, #2 has a problem, #3 they think you can solve, and #4 you cost less than the problem does—you're not getting a job offer.

Let's quickly break down the four conditions. #1: You've got to be in front of the person who can make the decision. Unless you're looking for a job in human resources, HR can't hire you. #2: The decision maker has to have a problem. Jobs exist because problems exist. #3: The decision maker has to believe that you can solve the problem. It's not enough to be a motivated, self-starter. And finally, #4: You have to cost less than the problem does. No one is going to pay you \$100,000 to solve a \$2 problem. It comes down to basic economics. (Professor Stermole was right all along, but you already knew that.)

Next time we'll discuss the "Three Questions Every Job Seeker Must Answer BEFORE They Begin a Job Search." Until then, focus on identifying problems and developing ideas to solve them. In the end, that's the only reason you'll ever get hired and solving problems is what your Mines education was all about anyway.

*Richard Hewitt, founder of High Impact Career Products, has spent the past five years developing and testing America's only patent-pending job finding system, [www.impactcareer.com](http://www.impactcareer.com), which alumni gain free access to with their CSMAA membership. Questions and comments can be emailed to Richard Hewitt at [richard@impactcareer.com](mailto:richard@impactcareer.com).*

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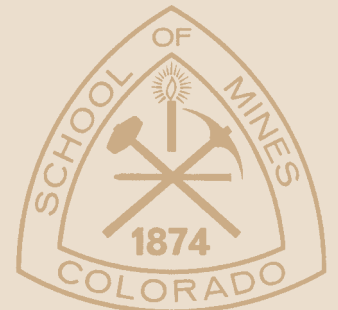
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## E-Days 'round the world

On March 29, 2007, alumni world-wide celebrated CSMAA's 2nd Annual E-Days 'Round the World. To view photos, visit <http://www.alumnifriends.mines.edu/edays07>.



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Oman



# Fast Forward

Class Notes  
Weddings  
Alumni Profiles  
Births  
Passings

1940

**Lester Newhouse** is retired and lives in Annandale, VA.

1943

**John W. Gabelman** is retired and lives in Butte, MT.

1950

**Cleveland Dear** is president of Border Petroleum. He lives and works in Junction, TX.

**Dr. H.K. van Poolen** of Penrose, CO, has been declared a LEGEND for pioneering work in the first generation of Hydraulic Fracturing (a process that revolutionized petroleum production) by the Society of Petroleum Engineers. The award ceremony was held at the annual meeting in San Antonio, TX. The award was the first of its kind for the Society.

1953

**Richard H. Mandel, Jr.** is president of American Western Group. He lives and works in Denver, CO.

1962

**Bill Sharp** had a grandson named Zane born on April 19, 2007, and posted Zane's picture on the minesreunion.org site! Check it out!

1963

**Michael C. Denlinger** is retired and lives in Temecula, CA.

**Fred Hilterman** was awarded the Maurice Ewing Medal during the 2006 Society of Exploration Geophysicists Annual Meeting. This is the Society's highest honor. Fred is on an extended leave of absence from the University of Houston where he holds the Margaret Sheriff professorship. He is currently chief scientist for Geokinetics Data Processing and Interpretation.

1964

**Dale D. Teeters** has retired as a mine inspector for Mine Safety & Health Administration of the U.S. Department of Labor. He lives in Lakewood, CO.

1965

**Lawrence G. Eagan** is retired and lives in McKinney, TX.

**Larry B. Green** is retired and lives in Grove, OK.

**William R. Wilson** is president and chief operating officer for New Horizon Uranium Corporation in Golden, CO. He lives in Arvada, CO.

1966

**John R. Schmedeman** sold his company JRS GeoServices Inc. last fall. He now lives in Hot Springs Village, AR.

1967

**Hamid J. Al-Hakeem** is retired and lives in Laguna Beach, CA.

1968

**Gregory Hal Hoyl** is president and chief executive officer for National Services Group Ltd. He lives and works in Santana de Parnaiba, Brazil. His e-mail is ghhoyl@attglobal.net.

1970

**Ronald L. Keil** is laboratory director for Huffman Laboratories, Inc. in Golden, CO.

**Robert C. Scharp** is director of Foundation Coal Holdings for Bucyrus International Inc. He lives and works in Monument, CO.

1971

**Philip E. Quinnett** is principal engineer for Olin Chlor Alkali Products. He lives and works in Cleveland, TN.

1972

**D. Victor Bush** is director of Long Energy Solutions in Englewood, CO.

**Nelson D. King** is manager for Pincock, Allen & Holt, Inc. in Brisbane, Queensland, Australia.

1973

**Logan T. MacMillan** is a geologist for the Anadarko Petroleum Corporation in Denver, CO.

**Ronald W. Pritchett** is a senior geologist for Noble Energy Inc. He lives in Centennial, CO.

## 1974

**Ricardo Moreno Campoy** is an independent consultant and mineral industry financial advisor. He lives and works in Larchmont, NY.

**Dave O. Cox** is vice president of Trident Resources Corp. in Lakewood, CO. He lives in Golden, CO.

**James S. Crompton** is manager of architecture and technology of Global Upstream IT for Chevron in Houston, TX.

## 1975

**Steven A. Barker** is process technical specialist for CoSyn Technology in Edmonton, Alberta, Canada.

**Jose A. Botin**, professor and chair for economics and business at the Universidad Politecnica de Madrid, in Madrid, Spain, is currently a visiting professor at CSM's Mining Engineering Department.

**Andrew P. Schissler** is engineering manager for Intrepid Potash - New Mexico LLC. He lives and works in Carlsbad, NM.

**Jimmy B. Taylor** is project developer for The Trane Company. He lives and works in Oklahoma City, OK.

## 1978

**Betty Ann Clark** is an information technology professional III at the University of Colorado. She lives and works in Boulder, CO.

**Francine D. Schlaks** is a federal mediator for the U.S. Equal Employment Opportunity Commission (EEOC). She lives in Miami, FL.

**Tim Stouffer** writes that he and his wife became first-time grandparents with the birth of Kaden Gabriel Burke on March 23, 2007. Parents are daughter, Angela, and son-in-law, Jeremy Burke. Kaden is also the first great-great-grandchild of Tim's 106-year-old grandfather, Jacob B. Stouffer.

**Andrew P. Swiger** is president of ExxonMobil Gas & Power Marketing Company. He lives and works in Houston, TX.

**Frederick N. Williams** is semi-retired and lives in Rowe, MA.

## 1979

**David A. Bird** is exploration advisor for Samson Resources in Denver, CO. He lives in Englewood, CO.

**Laurence G. Martin** is a senior geologist for X-Cal Resources Ltd. He lives in Sparks, NV.

**Luis J. Rodriguez** is associate partner for Down Stream Oil Company in Waterdown, Ontario, Canada. He lives in Oakville, Ontario. His home e-mail is Luis.R@sympatico.ca and his business e-mail is dsoc@sympatico.ca.

## 1980

**Charles E.C. Rense** is chief executive officer of MESA. He lives and works in Los Alamos, NM.

**Mark A. Wolf** is plant manager for E & J Gallo Winery in Fresno, CA. He lives in Modesto, CA.

**Genevieve B. Young** is a petroleum geologist for the Colorado Geological Survey. She lives and works in Denver, CO.

## 1981

**Leanne M. Baker** is managing director for Investor Resources LLC. She lives and works in Tiburon, CA.

**Scot Buell** and **Katy Templeton Buell** are living in Luanda, Angola. Scot is the base business manager for Chevron's Southern Africa operation. Katy is consulting for ExxonMobil's Angolan operations.

**James J. Emme** is executive vice president and chief operating officer for Elk Resources, Inc. He lives and works in Denver, CO.

# Profile

## Houston Geophysicist Works Tirelessly to Uplift the Oppressed

Professionally, **Kidane Araya** MSc '86, PhD '93 is a geophysicist and research scientist for SensorWise Inc. in Houston. In the evenings, over the weekend and sometimes during the lunch hour, Araya devotes himself to helping Eritreans and Ethiopians who are seeking asylum from religious and political persecution in their homeland. Whether this involves driving around town to visit detainees in his ancient Toyota Camry, or contacting the pastors, lawyers and members of the community who are working on their behalf, Araya is constantly on the move. "He always comes up with information, ideas, [and is] willing and ready to help. He doesn't give up," says Pastor Moges Tadesse of Houston's Ethiopian Evangelical Church. Araya was brought up in East Africa surrounded by political turmoil and violence, and he's made serving the oppressed a lifelong priority. His dedication has rubbed off on his sons Mussie "Moses" (25) and Aaron (23), who work with asylum seekers themselves during breaks from college. "I feel extremely proud of my dad, doing what he does, coming from where we came," Aaron says. "It makes you want to do the same thing." Araya explains that he sees his job as one of communication and consolation: "These people are often unable to communicate with the authorities, so they don't get a fair hearing. I can meet with them, relay their story and offer comfort at the same time. They are often very afraid." For more about his work, contact Araya at karaya11@gmail.com.



# Weddings

**Jennifer Ayers Brasher '00** was married to Randal Brasher in Santa Barbara, CA, on Oct. 14, 2006. She and Randal spent their honeymoon on St. Lucia.



**Greg '84** and **Alyssa Smallwood** were married in the Fullerton Hotel in Singapore on Jan. 6, 2007. Mines grads in attendance were **Ken '86** and **Shelley '85 (Nemanic) Curtis**, **Greg Cederstrom '86** and **Stephen Wood '87**.

**Paul G. Grundy** is manager of operations engineering for Chevron International Exploration & Production in Duri, Riau, Indonesia. His home e-mail is grundypc@sbcglobal.net and his business e-mail is Paul.Grundy@chevron.com.

**Daniel L. Sikorski** is service delivery manager for Schlumberger Oilfield Services. He lives in Hurricane, WV.

**Thomas L. Young** is advanced services engineering manager for Smith Technologies in Perth, Australia.

## 1982

**Judith L. Bolis** is senior engineer, mine closure and reclamation services, for URS Corporation in Denver, CO. She lives in Golden.

**Douglas V. Gallagher** is a manufacturing engineer for National Institute of Standards & Technology in Boulder, CO.

**Bernardo M. Rubio** is assistant operation manager of mills for Cia. de Minas Buenaventura S.A.A. in Lima, Peru.

## 1983

**Eric A. deMontigny** is senior project manager for Kennedy/Jenks Consultants, Inc. in Federal Way, WA.

**C. Thomas Heinzler** is corporate development manager for Anadarko Petroleum Corporation. He lives and works in The Woodlands, TX.

**E. Scott MacBride** is director of information technology for Ellora Energy in Boulder, CO. He lives in Castle Rock, CO.

**Steven D. McPherson** is operations manager for Anadarko Petroleum Corporation in Vernal, Utah. He lives in Vernal, UT.

## 1984

**Peter O. Sinton** is a hydrogeologist for Aqua-Geo, Ltd. in Conifer, CO.

**Greg** and **Alyssa Smallwood** were married on Jan. 6, 2007. Greg is project manager for Orion Technical Services in Singapore. He lives in League City, TX.

**Laurie A. Swanson** is senior project manager for Morris-Depew Associates, Inc. She lives and works in Ft. Myers, FL.

## 1985

**Erik E. Hansen** is a hydrogeologist for Shell Unconventional Resources Energy in Houston, TX. He lives in The Woodlands, TX.

**Daniel M. Larson** is manager for information technology for Hunt Oil Company in Lima, Peru.

**Brian J. Smith** is special projects manager for Anadarko Petroleum Corporation in Evans, CO. He lives in Thornton, CO.

**Linda S. Tully** is a senior software engineer for Northrop Grumman. She lives and works in Colorado Springs, CO.

## 1986

**Masami Hato** is deputy general manager for Earth Remote Sensing Data Analysis Center (ERSDAC) in Tokyo, Japan.

**Nathaniel E. Putzig** received his PhD in Geophysics in 2006 from the University of Colorado at Boulder. He is currently a post-doctoral research associate at Washington University for the Department of Earth and Planetary Sciences. He lives and works in Saint Louis, MO.

**Joseph F. Titzer** is Middle East business development manager for Baker Hughes Inc. in Doha, Qatar.

## 1987

**Steven R. Fox** is technical consultant for AERA Energy, LLC in Bakersfield, CA.

**Michael C. Kimble** is president of Reactive Innovations, LLC in Littleton, MA.

**Gary L. Parham** is associate manager for Lockheed Martin Corporation in Denver, CO. He lives in Lakewood, CO.

**William A. Sawyer, Jr.** is president of Wolverine Pipe Line Company. He lives and works in Portage, MI.

## 1988

**Audrey Fasching** reports that she started a new job as senior metallurgist with Memry Corporation in Menlo Park, CA. Memry Corp. is a nitinol tube and wire manufacturer.

**Charles C. McConnell** is principal engineer for Southern Star Central Gas Pipeline in Owensboro, KY. He lives in Newburgh, IN.

**Scott Miller** was promoted to Refinery Manager at Safety-Klean's East Chicago Refinery.

## 1989

**Linda N. Bliss** is manager of supply planning and launch projects for EMD Serono, Inc. in Rockland, MA.

**Lloyd W. Easton** is managing director for EPC Integration Limited. He lives and works in London, England. His home e-mail is Lloyd\_Easton@hotmail.com and his business e-mail is Lloyd.Easton@epcintegration.com.

## Alumni

Fast Forward

**Timucin Kilinc** is business improvement facilitator for BHP Billiton Ltd. in George Town, Tasmania, Australia.

**Bryan J. Kinderman** is senior product manager for Sun Microsystems, Inc. He lives in Superior, CO.

**Michael S. Lichtwardt** is director of supply chain Americas / Asia Pacific for Cytec Engineered Materials in Havre de Grace, MD.

### 1990

**Jeffrey J. Jacoby** is plant manager for Vulcan Materials Company in Avondale, AZ. He and **Maureen K. (Pretty) Jacoby '91**, live in Peoria, AZ.

**Christopher M. Sellstone** is continuous improvement manager for Ocean Spray Cranberries in Middleboro, MA.

**Omar A. Suwaina** is exploration manager for Abu Dhabi National Oil Company (ADNOC) in Abu Dhabi, United Arab Emirates.

### 1991

**Elizabeth A. Loveland** is process and controls engineering supervisor for Onyx Engineering, Inc. in Corpus Christi, TX.

**James H. Ruble III** is manager of process engineering for Valero in Krotz Springs, LA.

### 1993

**Beth E. Hunter** is an engineer III for Navigant Biotechnologies, LLC in Lakewood, CO. She lives in Arvada, CO.

**Eric T. Lyons** is senior controls engineer for Stone Technologies, Inc. in Chesterfield, MO. He lives in Hazelwood, MO.

### 1994

**Charles Brokaw** and **Aj Earnheart Brokaw** announce the birth of their first child, Charles Morgan on Feb. 24, 2007. The three Brokaws live in Leadville, CO.

**Bryan J. Burinda** is a log analyst for Halliburton Sperry Drilling Services in Anchorage, Alaska. He and **Christine G. (Bartlett) Burinda '96**, live in Anchorage, AK.

**Debra M. DeCrausaz** is project manager for Tetra Tech. She lives and works in Breckenridge, CO.

**Michael R. Niznik** is a staff drilling engineer for ExxonMobil Qatar.

### 1995

**Douglas** and **Tiffany '94 Abbink** are pleased to announce the birth of their third child, Joshua Dean Abbink. He is welcomed by his

big sister Lauren Ashton (6) and big brother Cole Chapman (3).

**John B. Brown** is a project manager for Baker Hughes INTEQ in Jakarta, Indonesia.

**T. Jasper Fai** is an information systems specialist for Amgen Inc. in Longmont, CO.

**Brian W. Fehr** is equipment engineer for Micron Technology, Inc. He lives and works in Boise, ID.

**Evangeline C. Simones** is a consultant for Simones Enterprises in Littleton, CO.

### 1996

**Christine G. Burinda** is a field optimization specialist for Halliburton Sperry Drilling Services in Anchorage, Alaska. She and **Bryan J. Burinda '94**, live in Anchorage, AK.

**L. Michael Cheeseman** is director of mergers and acquisitions for Halliburton in Houston, TX.

**Jennifer Gadberry-Hadrys** is search professional for Cardinal Law Group in Evanston, IL. She and **William A. Hadrys III**, live in Ventura, CA.

**Maia C. Hunt** is a plant engineer for CII Carbon LLC. She lives and works in Robinson, IL.

**Jonathan S. Keller** is chief of the tactical radio branch for the U.S. Department of Defense in Fort Manmouth, NJ. He lives in Tinton Falls, NJ.

**Jesse F. White** is a project engineer for ALSTROM in Oslo, Norway.

### 1997

**Donna S. Anderson** is geological specialist for EOG Resources, Inc. in Denver, CO. She lives in Golden, CO.

**Daniel P. Freed** is senior commercial advisor for Total E&P UK Plc. in Aberdeen, United Kingdom. His e-mail address is daniel.freed@total.com.

**Christopher M. Gilbert** is project manager for General Growth Properties.

**Wm. Mark Hart** is president and chief executive officer of West Hawk Energy in Vancouver, British Columbia, Canada. He lives in Denver, CO.

**Steven Meiggs** is principal consultant, FL P.E. & P.G., for Design and Construction for Professional Service Industries, Inc. in Tampa, FL. He writes that in addition to his many projects, he is "also the lead/senior engineer

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CSM Foundation Inc. Linda M. Landrum at (303) 273-3142

# Profile

## Nurturing the Next Generation of Engineers

Engineers like to design and build things. They also like to take things apart and occasionally blow them up. **Penny (Hill) Ouellette** '90 is helping Alpine Elementary School students explore and develop these skills. Her Odyssey of the Mind team recently won first place at the Colorado Odyssey of the Mind state tournament and went on to compete at the World Finals at Michigan State University during the last week of May.

Her "Tag 'Em" team designed, built and occasionally destroyed a vehicle as part of Odyssey of the Mind. The program provides opportunities for kindergarten through fifth-grade students to create, design and build their own solutions to rigorous challenges based on a strict set of guidelines. The children do all the work, from concept creation through implementation and presentation to judges and an audience. "Children experience the satisfaction of using their creativity, intellect, perseverance and hands to overcome difficult challenges," says Ouellette, who graduated from Mines with a degree in metallurgical and materials engineering, and is now the program development director for Orion Registrar in Arvada, CO. For more information, contact Penny at Penny@orion4value.com.



for [the] company's largest Advanced Environmental Group." He and wife, Melissa, have two boys, Ethan (4) and Alex (16).

**Todd M. Mundorff** is lead production planner for BP West Coast Products in Carson, CA. He lives in Lomita, CA.

**Jennifer A. Van Dinter** is an associate for BMO Capital Markets in Denver, CO.

**Derek and Mellanie (Maynard) '99 Webb** announce the arrival of twins, Maya Grace and Draper Edward, born May 1, 2006. Derek writes, "a year and way too many doctor's appointments later they are doing quite well. Their big sister, Madilyn, is three and loves playing with them. She does so much to help Mom and Dad take care of her baby brother and sister, except change their diapers!" Derek is a design engineer for Muller Engineering in Lakewood, CO, and Mellanie is now in her eighth year with Level 3 Communications. The family lives in Arvada.

### 1998

**Jeremy R. Jessen** is technical marketing engineer for Agilent Technologies, Inc. in Loveland, CO.

**Jess Kindler**, his wife Kyndra and family moved to Elko, NV, where he is heading up Atlas Copco's operation, which is responsible for servicing and selling to underground and surface mines in the Western U.S..

**Lisa Kerschner Schwien** and husband, Jarrett, welcomed Lauren Marjorie to their family on Sept. 8, 2006. Lauren joins her sister, Isabelle, and brother, Colton.

**Hirofumi Yamamoto** is a reservoir engineer for OXY Permian in Midland, TX.

### 1999

**Matthew T. Halker** is owner of Halker Consulting LLC in Parker, CO.

**Georgeanna N. Lynch** is regional manager for Pinyon Environmental Engineering Resources. She lives and works in Saratoga Springs, NY.

**Gordon L. Olson** was promoted to vice president of engineering at Pinnacle Gas Resources, Inc.

**Kelly Nikel Reiber** is a senior engineer for Apache Egypt Companies in Houston, TX.

**Eric L. Smith** is superintendent of contract management for the Freeport Indonesia Company in Tembagapura, Papua, Indonesia.

**Bernadette Thornton** has moved to the Process Automation Department of Chevron's Energy Technology Company in Houston, TX, after six years in Control Systems Engineering at KBR.

**Nathan Wanstrath** is proud to announce the birth of his first son, Henry Norman, on March 21, 2007. Henry was welcomed home by sisters Anna and Alyssa.

### 2000

**Jennifer Ayers Brasher** was married in Santa Barbara, CA, on Oct. 14, 2006 to Randal Brasher. In Jan. 2007, she began her new job as transmission planning engineer for Renewable Energy Systems Americas in Austin, TX.

**Misha (Gibson) Farrell** was married to Devin Farrell in Spring, TX, on April 20, 2007. They reside in Humble, TX.

**Ryan G. Fisher M.S.** is a petroleum geologist for Norwest Questa Engineering in Golden, CO.

**Andrea Trujillo Guajardo** is advertising manager for The Monroe Street Journal in Ann Arbor, MI.

**Vanessa L. Henderson** is a NEPA specialist for the Colorado Department of Transportation in Denver, CO.

**Erik R. Kling** is a geologist I for EOG Resources, Inc. in Denver, CO.

**Nick Pigott** has recently accepted the position of vice president of operations for Pinnacle Metals, Inc. in Freeport, IL.

**Jennifer S. Shane** is an assistant professor at Iowa State University in Ames, IA.

**Christian Sutton** is pleased to announce the birth of his second son, Peter Andrew Sutton, born April 3, 2007 in Katy, TX, weighing 9 lbs 14 oz.

**Rachel S. Wilde** is an application engineer for Woodward in Mundelein, IL. She lives in Evanston, IL.

**Matthew M. Williams** is a development review engineer for Douglas County Government in Castle Rock.

## 2001

**Christopher Cody Duran** is senior operations engineer for Pioneer Natural Resources in Denver, CO. He lives in Castle Rock.

**Abby Browder Hyams** and David Hyams welcomed Mia Isabella Browder Hyams to their family on Aug. 25, 2006, weighing 6 lbs 6oz and measuring 21" long. The Hyams enjoy living in Denver, CO where Abby works for URS Corporation.

**Tracy Marie Perry** is associate III for Wiss, Janney, Elstner Associates in Lakewood, CO.

**Scott A. Strong** is a graduate assistant in the Mathematical and Computer Science Department at the Colorado School of Mines.

## 2002

**Shalyn M. Gerczak** is heat treat operations supervisor for Caterpillar, Inc. She and **John M. Gerczak '01**, live in Peoria, IL.

**Juliana F. Julian** is office manager for Power-tuff Corporation in Houston, TX. She lives in Kingwood, TX.

**Stefani D. Whittaker** is a petrophysical engineer for The Discovery Group in Denver, CO.

## 2003

**Robert Applegate** and his wife Natalie announce the arrival of Christopher Dane Applegate, born Feb. 24, 2007.

**Emma E. Buccambuso** is a part-time faculty member at Metro State College in Denver, CO.

**Justin Carlson** is a policy specialist for Policy Communications. He lives and works in Golden, CO.

**Raymond T. Surface** is an engineer for Washington Group International, Inc.

**Albert C. Templeton** is mining and environmental manager for Acme Brick. He lives and works in Castle Rock, CO.

**Jesse J. Terry** is an operations engineer for Pioneer Natural Resources in Irving, TX.

**Nathan Torres** and his wife Natalie announce the birth of Aiden Nathaniel Torres on July 14, 2006.

**Jessica G. Tylicki** is a senior scientist for Johnson and Johnson Consumer and Personal Products Worldwide in Skillman, NJ.

**William Asa Vandermeer** is a project engineer for Navarro Research & Engineering. He lives and works in Golden, CO.

## 2004

**Adrien K. Butler** is a staff engineer for Tetra Tech in Golden, CO.

**Aspen L. (Obering) Coombs** was married to Christopher Kelly Coombs on Aug. 12, 2006, in Black Forest, CO.

**Kathleen Dano** and her husband, Mike, welcomed their first child, Owen, born at home on April 8, 2006.

**Juergen Dreier** is a reservoir engineer for Wintershall in Moscow, Russia. His home address is in Mittertrixen, Austria. His business e-mail is juergen.dreier@wintershall.com and his home e-mail is juer\_dreier@yahoo.de.

**Sarah E. Enoch** is an implementation consultant for Fast Enterprises, LLC. She and **John H. Enoch '04**, live in Rochester, IL.

**Bonnie E. Harber** is a CoilTOOL Product Champion for Schlumberger in Red Deer, Canada.

**Donald J. Keighley** is a geologist for EnCana Corporation in Denver, CO.

**Aaron M. Lane** is an office engineer for Hensel Phelps Construction Company in San Diego, CA. He lives in Carlsbad, CA.

**Angela K. Lemmerman** is senior staff engineer for STRATA, Inc. She lives and works in Boise, ID.

**Morgan McArthur** is a staff geotechnical engineer for GeoEngineers. He lives in Tacoma, WA.

**Jenelle M. Morris** is health and safety manager for CH2M Hill, Inc. in Englewood, CO.

**Charles P. O'Keefe** is a software engineer for Northrop Grumman. He lives in Denver, CO.

**Travis C. Porter** is an electro-optical engineer for the Lockheed Martin Corporation.

**Michael D. Rumon** is a geologist for EnCana Oil & Gas (USA) Inc. in Denver, CO.

**Nathan C. Thomas** is a research engineer for Dow Chemical. He lives in Clute, TX.

**Yegor A. Zharikov** is a production engineer for BP in Houston, TX.

## 2005

**Dustin M. Bashford** is a systems engineer for Kinder Morgan, Inc. in Lakewood, CO.

**Patrick L. Carroll** is a project engineer for Wildcat Construction.

**Mark P. Chung** is an energy analyst for Ben-tek Energy LLC.

**Charles C.G. Cooper** is a product engineer for Synchroness Inc.

**Byron R. Evans** is civil field engineer for Bechtel Construction Ops, Inc. in Gig Harbor, WA. He lives in Las Vegas, NV.

**Jeffrey J. Field** is a graduate student at the Colorado School of Mines.

**Emily J. Gibson** is project engineer for Jehn Engineering in Temecula, CA. She lives in Carlsbad, CA.

**Ryan J. Hubbard** is an electrical engineer for Stanley Consultants, Inc.

**David T. McMillan** is a staff engineer for Dietrix Standard Inc. in Longmont, CO.

**Anna E. Pechatnikov** is an analyst for Goldman Sachs & Co. in Houston, TX.

**Jennifer Staub** is a petroleum engineer in the Oil and Gas Division for the North Dakota Industrial Commission in Williston, ND.

**Timothy C. White** is an electrical engineer for the U.S. Geological Survey in Golden, CO.

**Regina C. Wong** is a science and technology analyst for the U.S. Government in Washington, DC. She lives in Falls Church, VA.

## 2006

**Mahmood Ahmadi** is a petroleum engineer for Norwest Questa Engineering in Golden, CO. He is also pursuing his PhD at Mines.

**Ali M. Al-Sumaiti** is a graduate student pursuing his PhD at the Colorado School of Mines.

**Manuel A. Amaro** is an engineer I for Noble Energy.

**Heather K. Angel** is a biomedical engineer for The Children's Hospital of Denver, CO.

**Megan L. Atwood** is geologist I for Fidelity Exploration & Production Company in Denver, CO.

**Olusola Bakare** is an earth scientist for Chevron Nigeria Limited.

**Robert S. Bergren** is a quality engineer for Trane in Pueblo, CO.

**Jennifer Sanae Bradtmueller** is a staff engineer for CH2M Hill, Inc. in Englewood, CO.

**Craig S. Brooker** is project engineer for The Ballard Group in Lakewood, CO.

**Tiffany D. Burton** is a manufacturing engineer for Ice-O-Matic/Mile High Equipment Co.



# Class of 2028



Christopher Dane Applegate was born on Feb. 24, 2007 to **Robert Applegate '03** and his wife Natalie.



**Douglas '95 and Tiffany '94 Abbink** are pleased to announce the birth of their third child, Joshua Dean Abbink. He is welcomed by his big sister Lauren Ashton (6) and big brother Cole Chapman (3).



**Christian Sutton '00** is pleased to announce the birth of his second son, Peter Andrew Sutton, born on April 3, 2007 in Katy, TX.



**Derek '97 and Melanie (Maynard) '98 Webb** announce the arrival of twins, Maya and Draper, born May 1, 2006.



Aiden Nathaniel Torres was born to **Nathan Torres '03** and his wife Natalie on July 14, 2006.



Mia Isabella Browder Hyams was born to **Abby Browder Hyams '01** and David Hyams on Aug. 25, 2006.



**Charles Brokaw '94 and Aj Earnheart Brokaw '94** announce the birth of their first child, Charles Morgan, on Feb. 24, 2007. The three Brokaws live in Leadville, CO.



**Lisa Kerschner Schwien '98** and husband, Jarrett, welcomed Lauren Marjorie to their family on Sept. 8, 2006. Lauren joins her sister, Isabelle, and brother, Colton.

**Sean T. Cavanagh** is an engineer for BOA Technology.

**Sean M. Cole** is a mechanical engineer for Syncron Inc. in Westminster, CO.

**Chad W. Conry** is an engineer I for The RMH Group, Inc. in Lakewood, CO.

**Stephanie L. Cook** is a geoscientist I for Williams Exploration and Production in Denver, CO.

**Huy Q. Dang** is a capital projects engineer for Chevron Phillips Chemical Company LP.

**Dominic A. DiBrito** is a senior engineer for LTK Engineering Services in Denver, CO.

**Michael J. Dunaway** is a civil engineer for the Shaw Group.

**Eric E. Eckberg** is a geologist for Newcrest Resources, Inc. in Lakewood, CO.

**Jorge V. Fandino Betancourt** is a reservoir engineer for Independent Resources in Rome, Italy.

**Cathy E. Flaherty** is a systems engineer for Lockheed Martin Corporation in Colorado Springs, CO.

**Marieke W. Gaudet** is a geologist for Occidental Oil and Gas Corporation in Long Beach, CA.

**Nicholas W. Geanetta** is a consultant for Anow Systems in Denver, CO.

**Jeffrey B. Gillow** is principal scientist for Arcadis U.S., Inc. in Highlands Ranch, CO.

**Andrew M. Govert** is a geology intern for Shell Rocky Mountain Production.

**Christopher A. Green** is a petroleum engineer for Perenco in Great Yarmouth, Norfolk, United Kingdom.

**Kristina L. Griffis** is a petroleum engineer for El Paso Exploration and Production Company in Denver, CO.

**Ronald Gutierrez** is a geologist for Mauricio Hochschild Cia. Ltda. in Lima, Peru.

**Shannon M. Higgins** is a geomechanical engineer for Schlumberger, Ltd. in Greenwood Village, CO.

**Tyson F. Ingels** is an engineer-level 3 for Malcolm Pirnie in Denver, CO.

**Mehdi Izadi Kamouei** is a graduate student pursuing a PhD at the Colorado School of Mines.

**Praveen Jha** is senior research chemical engineer in the Advanced Technology Center for Matheson Trigas, Inc. in Longmont, CO.

**Benjamin S. Johnson** is a project engineer for Malcolm Pirnie in Denver, CO.

**Travis Jones** is a research assistant at the Colorado School of Mines.

**Jeong Min Lee** is manager for Korea Resources Corporation in Seoul, South Korea.

**Jennifer E. Leisch** is a post doctoral research associate in the Stanford Synchrontron Radiation Lab in the Stanford Linear Accelerator Center at Stanford University in Menlo Park, CA.

**Timothy J. MacIntyre** is a consulting geologist for New Horizon Uranium in Golden, CO.

**Brian J. McMorrow** is a research associate at the University of Arizona in Tucson, AZ.

**Erin E. Meyers** is a geoscientist for Chevron in Houston, TX.

**T. Dylan Mikesell** is a graduate student at Boise State University in Boise, ID.

**Matthew Morgan** is a geologist II for the Colorado Geological Survey in Denver, CO.

**David Noe** is senior engineering advisor and state mapping program manager for the Colorado Geological Survey in Denver, CO.

**Dallas J. Nutsch** is a graduate student at the Colorado School of Mines.

**Oluwasijibomi O. Okeowo** is lead research engineer for Chevron in Richmond, CA.

**Jon M. Orth** is a product specialist for Par Tech Inc. in Boulder, CO.

**Manuel Leonardo Padilla Palma** is district geologist for Servicios Industriales Peñoles in Chihuahua, Chihuahua, Mexico.

**Celso Lizardo Palacios** is Peru generative project chief for Mauricio Hochschild & Cia (ARES) in Lima, Peru. He is working for a growing Peruvian company with several Ag-Au mines in operation and it also has an aggressive exploration program in Peru and other countries in America

**Kyle E. Richards** is a staff hydrogeologist for Arcadis in Highlands Ranch, CO.

**Derrick R. Rodriguez** is a research associate at the Colorado School of Mines.

**Banasri Roy** is a post doc in the Materials Engineering Department at the New Mexico Institute of Technology in Socorro, NM.

**Alison M. Ruhs** is an environmental scientist for the U.S. Environmental Protection Agency in Denver, CO.

**Erin M. Rundberget** is an ABM student for the U.S. Air Force in Panama City, FL.

**Jason Rurup** is a generation modeling analyst for Xcel Energy in Denver, CO.

**Jeffrey R. Schaefer** is an engineer for EnCana.

**Benjamin J. Schlegelmilch** is a maintenance supervisor trainee for Leprino Foods. He lives in Hanford, CA.

**Adam A. Schmetzko** is a mechanical engineer for Harris Group, Inc. in Denver, CO.

**Kin-Ling Sham** is a graduate student at the Colorado School of Mines.

**Wade W. Simmons** is a software engineer for Tyler Technologies in Lakewood, CO.

**Geoffrey D. Slade** is a field engineer for Kiewit Western Co. in Littleton, CO.

**Paul M. Suprenand** is senior associate for Amgen Inc. in Longmont, CO.

**Robert R. Tonnsen** is a petroleum engineer for EnCana Oil & Gas (USA) Inc. in Denver, CO.

**Jonathan M. Wilson** is a facilities engineer for ExxonMobil Corporation in Houston, TX.

**Ellen Xu** is a geophysicist in the D&P Geophysics Section of the Subsurface Imaging Division for the ExxonMobil Upstream Research Company in Houston, TX.

# Profile

## Serena Garcia '94 Encourages Hispanic Girls to Become Engineers



As a child, while working on her grandparent's ranch on the Antonito cattle ranch in the San Luis Valley, **Serena Garcia** '94 learned a lot about being an engineer. The daily work of tending the animals and helping with chores around the ranch involved hard work and problem solving. "The experiences I had while on the ranch gave me the discipline to tackle anything that comes my way today," she said. Thirteen years after graduating from Mines, she is running a successful consulting business in Houston and was recently profiled in a book, *¡Ay Mija! Why Do You Want To Be An Engineer?* which tells the childhood stories of 12 successful Latina engineers. Garcia is actively involved in the Society of Hispanic Professional Engineers and proceeds from the book will go toward scholarships offered by the Society. Her own decision to become an engineer was influenced by a summer engineering camp she attended on the Mines campus. When it was time for her to decide on college, Mines was at the top of her list. Descended from one of Colorado's founding families, Garcia is a third-generation college graduate, but she's the first engineer in her family. Now she wants to encourage other Latinas to consider engineering and her lessons are passed on to the next generation in this book, which was recently named a "2007 KidPower Award Finalist." *¡Ay Mija!* is available at [www.ahetems.org](http://www.ahetems.org).



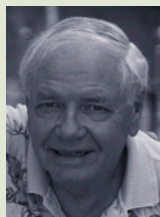


# Passings

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

—Thomas Campbell 1777-1844

**JAMES FRANK BRAYTON** '82 of Midland, TX, died on Dec. 15, 2006. Born on Sept. 17, 1959 in Pasadena, CA, he moved to Colorado when he was 13. After earning his undergraduate degree in petroleum engineering from Mines, he worked for POGO Producing until the time of his death. He was married to Jennifer Michelle Burton on Nov. 22, 2003 in Midland, and their son Caleb arrived a few years later—he had greatly anticipated the birth of their daughter. An active member of Mid-Cities Community Church, he also loved the outdoors. He is survived by his wife, Jennifer; his son, Caleb James; his daughter; his parents, Roger and Joan Brayton of Midland; one sister, Deborah Scott; and his brother, John Brayton.



**RONALD LEE BREDEHOFT** '60 of Upland, CA, died on March 15, 2007 at Chino Valley Medical Center. Born on Jan. 4, 1938, Ron grew up in Sterling, CO, graduating from high school in 1956. After completing his degree in chemical engineering at Mines, he served as an officer in the U.S. Army Reserves. He was employed by Chevron for 32 years and KTI/Technip for the remainder of his career. An avid sportsman, he met his wife

Judith on a fishing trip in the late sixties. An active member of the Lutheran Church, he took particular pleasure in organizing a church-sponsored camp for the hearing impaired which continues today. He leaves his wife, Judith; son, Jonathan; his two daughters, Anne Marie and Kristin; and six grandchildren.



**ROBERT W. DALTON** '57 of Tucson, AZ, died on June 9, 2006. Born on Jan. 12, 1932 in Golden, Bob met and married his wife of 52 years while earning his degree in mining engineering. After graduation, he reported to Ft. Riley, KS, where he served for two years as a first lieutenant in the First Engineer Battalion of the First Infantry Division. Following his discharge, Bob embarked upon a long and successful career as a mining engineer and consultant, and remained active in this capacity

to the time of his death. In 1973 the family settled in Tucson, where he founded the Sabino Engineering and Manufacturing Co. A devoted husband and father, he is remembered by his family and friends for his deep faith, keen intellect and love for the outdoors and sports, especially golf. He is survived by his wife, Kay; his two daughters, Mary and Julia; three sons, Robert, John and Michael; six grandchildren; and three siblings, Don, Frank and Mary.



**Alexis M. Dodin** '98 of Buenos Aires died on March 13, 2007 in Aspen, CO. Born in France, he grew up taking frequent trips to the Alps and the French coast where he developed a passion for skiing, snowboarding and waterskiing. When he came to Colorado to earn his master's degree in mineral economics in 1996, he was exhilarated by the open country and sense of space, and spent much time exploring the mountains with friends.

After graduating, he began working for Total, trading electricity and gas, first in London, then Houston and finally Buenos Aires. With ambition and great talent, he quickly earned the respect of his colleagues and rose rapidly through the ranks—in Houston, he

assumed responsibility for uniting the company's global energy trading systems and in 2006 he took the number two position for Total's gas and electricity operations in Argentina. His love for exploring nature was mirrored by an intense intellectual curiosity—he read avidly on a broad range of subjects. And as a friend and colleague, he was helpful and supportive, giving freely of his time to those who asked. He is survived by his parents, Christine and Michel Dodin; his sister, Camille; and his fiancée, Marina Lijo Pavia.



**JAMES D. HOLLIMAN** '58 of Bismarck, ND, died on Jan. 26, 2007. He was born on Feb. 18, 1928 in Hamburg, IA, where he remained until joining the Navy in 1945 immediately after finishing high school. He served on the USS *Iowa* until 1947. While earning a degree in business and finance from the University of New Mexico, he met his wife of 51 years, Mary Helen Garcia. After later obtaining his professional degree in petroleum

engineering from Mines, Don began working for Standard Oil of California. In 1965 he moved his family to Casper, WY, and went to work for Conoco. In 1972 he began working for MAPCO in Billings, MT. He retired from CNG in Tulsa, OK, after a 30-year career. A devoted father and husband, his family always remained his paramount priority. He had a great love for the outdoors—skiing, fishing and camping in particular. He also enjoyed golfing and bowling. He is survived by his wife, Mary Helen; his two sons, Jim and Joe; his daughters, Elena and Denise Lee; two grandchildren; and his sister, Joyce Jones.



**MAHIR M. JALILI** '71 of Aspen, CO, died on Aug. 24, 2006. After graduating from Mines in 1971 with a master's degree in chemical engineering, he went on to earn his J.D. from Loyola University of Chicago School of Law. After graduation, he moved to London to practice international law and arbitration, where he qualified as a barrister. In 2001, he won a landmark case on behalf of a consortium of European contractors in the Supreme Court of Saudi Arabia. Although he continued to maintain offices in both London and Chicago throughout his career as an international arbitrator, he had a strong affinity for Aspen and called the town home. He is survived by his wife, Margaret.

**ALEC JAMIESON** '43 of Quakertown, PA, died on Feb. 22, 2007 in St. Lukes Hospital, Quakertown. Born in Parkgate, England, he came to Colorado in the late thirties to earn his degree in mining engineering. After graduating, he began a 37-year career with the Navy, serving in World War II and Korea, and rising to the rank of Lieutenant Commander. He later went to work for the Fuller Co. in Catasauqua, PA, where he was a mining engineer. He served as chairman of the Richland Township Board of Supervisors for 18 years, and he was a member of the Perkasio American Legion, the Quakertown Masonic Lodge and the Quakertown United Methodist Church. He is survived by his wife of 50 years, Ruth Jamieson; his son, Alec; and his brother, George.

**WILLIAM S. KING** '49 of Bakersfield, CA, died on Dec. 11, 2006. Born in Grand Junction, he grew up in Denver, attending South Denver High School before coming to Mines, where he was a member of Sigma Gamma Epsilon, Tau Beta Phi, Blue Key and the Society of Exploration Geophysicists. During breaks from his studies, he found time to ski and climb in the mountains. After meeting Virginia Wessen, his future wife, and completing his degree in geology and geophysics all in the same year, he moved to Santa Paula, CA, to work for Texaco as a petroleum geologist. In 1954, he transferred to the Los Angeles office and three years later went to work for Wm. Ross Cabeen and Associates, an exploration firm in North Hollywood. He traveled extensively in the Middle East and Latin America. In 1974 the family moved to Bakersfield, where Bill had accepted a position with Occidental Petroleum Co. in the Latin American Division. He enjoyed annual trips to Zermatt, Switzerland, and numerous skiing and camping trips with his family, most recently spending summers in Crested Butte. He is survived by his wife of 56 years, Virginia; his daughters, Susan Mills and Sally Osborne; his son, Steven; his brother, Ben; and his sister, Becky McDill.



**ROBERT McMILLAN** '41 of Lakewood, CO, died on Dec. 18, 2006 at his home. Born Nov. 2, 1915 in Denver, he graduated from Manuel High School in 1933 and completed his degree in geological engineering in the early forties. In 1937 he married his wife of 55 years, Jewel Roach, with whom he had three children. With an infectious smile and great optimism, he treated each new day

as an adventure. He loved to travel, as well as spend time at home with family and friends. His professional work in geological research took him all over the world. He leaves his son, Stuart; his daughter, Beth McMillan Hough; seven grandchildren; and eight great-grandchildren. He was predeceased by his wife Jewel; and his son, Robert Bruce.

**JOHN P. McNAUGHTON** '42 of Alvarado, TX, died on Oct. 30, 2006 at his Texas ranch. Born in 1918 in Miami, OK, he earned his undergraduate degree from the University of Oklahoma before coming to Mines to earn his master's degree in petroleum engineering. He served in the U.S. Army during World War II, attaining the rank of major before being honorably discharged. In 1941 he married his best friend whom he had known since birth in Miami, Bettye Lee Robinson. The couple moved to Fort Worth in 1953 to work for Neville Penrose. John was very active in the Baptist community. He served on the boards of directors for several organizations, including the Southwestern Baptist Theological Seminary, B.H. Carroll Theological Institute and the Buckner Benevolence Board. His love for helping children was apparent through his work with the International Student Ministry. He was a proud member of the Peoria Indian Tribe of Oklahoma and was a rancher at heart. After retiring, he and Bettye split their time between their home in Fort Worth and their ranch in Alvarado. He leaves his wife of 65 years, Bettye Lee Robinson McNaughton; his daughters, Linda McNaughton Burton and LeeAnn McNaughton Hayes; his son, John Allenn; six grandchildren; and five great-grandchildren.



**WARD O'MALLEY** '42 of County Tipperary, Ireland, died on Dec. 29, 2006 at the age of 88. Born in New York as the son of Frank Ward O'Malley, a legendary reporter with the *New York Sun*, he spent a substantial portion of his childhood living in France and Switzerland. In 1932, after the death of his father, he returned to the United States and graduated from Exeter Academy, NH, in 1936. He spent a year at Princeton, studying French and Literature, and then enrolled at

Mines where he graduated four years later with a degree in mining engineering. During World War II he enlisted in the Eighth Engineers, First Cavalry Division as a second lieutenant. After the war, he worked in Ecuador for a gold mining company, returning to the U.S. in 1946 to complete a master's degree in geology at Stanford University. His years working in the oil industry took him all over the world, including lengthy stays in Ankara, Turkey, and Teheran, Iran. In 1959, he visited and fell in love with Ireland, where his passion for horses and fox hunting was given full rein. Ward continued to hunt and play polo up to the end of the Millennium—for his 80th birthday, he bought himself two polo ponies. He is survived by his wife, Catherine.



**SIMON M. OZANNE** '99 of Maplewood, NJ, died on March 13, 2007 in Aspen, CO. Born on Guernsey, one of the UK's Channel Islands, he was studious and introspective as a young man, finding voice for his creativity through music and art. In 1994 he began his undergraduate education at the Camborne School of Mines in Cornwall, England, where he discovered a passion for rugby and the outdoors. After graduating from Camborne in

1996 with a first in Mining Engineering, he worked in the United Arab Emirates for Steven Rock, before joining Rock Engineering in Perth, Australia. He came to Mines to begin his master's degree in Engineering in 1997. While based in Golden, he made the most of living close to the mountains, spending many weekends with friends skiing and climbing. After graduation, he went to work for the international management consulting firm Marakon Associates in New York City. With a quiet determination, a clear focus and genuine warmth, he quickly proved his value to the organization and had been made partner in early 2007. He met his US-born wife, Jennifer Specht Ozanne, in London while traveling for business—they were married in Jamaica in spring 2003. And he had looked forward with great anticipation to the arrival of their first child—Jennifer gave birth to their son, Gavin Simon, in early April. Although he settled far from his UK-based family, he was always in close contact and visited frequently. He is survived by his wife, Jennifer; his son, Gavin; his parents, Martin and Josephine Ozanne; his sister, Kate Ozanne Bridges; and his brothers, Michael and Stephen Ozanne.



**JAMES L. SAMPAIR** '54 of Raleigh, NC, died on July 16, 2006. After graduating from Mines in the mid-fifties, he took a position with Arabian-American Oil Company (ARAMCO) in Saudi Arabia. After two years in the Middle East, he took an exploration position with Texaco, which took him to Louisiana, Virginia, and finally Ohio. After his tenure with Texaco, he moved to North Carolina in 1967

and began contract work for Texas Gulf Sulfur. He then secured a position with the state of North Carolina as state geologist for the

coastal plains region. During this time, much of his energy was devoted to developing the water resources of Eastern North Carolina. In 1982 he formed Villanova Natural Gas Inc., focused on locating and extracting oil and gas reserves in Ohio, Pennsylvania, and western New York. He retired in 1992. He is survived by his wife, Sylvia Sampair; and five sons, Michael, Steven, Timothy, Thomas and Christopher.

**JOHN F. SANTORA** '63 of Winchester, OR, died on Aug. 9, 2004. He was born in New York City in 1935. After completing his degree in mining engineering, he served in the United States Navy. He started his career working for the Bureau of Reclamation in Golden, and later Willows, CA. Under the Bureau of Land Management, he worked in Fairbanks, AK; Washington, D.C.; Ukiah, CA; and finally Anchorage, AK, where he was deputy state director for minerals, and oversaw the Alaska Pipeline production and activities. After 30 years of federal service, he retired to Winchester, OR. During retirement he pursued a lifelong passion for building and flying model airplanes and helicopters, as well as building model boats. He is survived by his wife, Barbara; his mother, Nathalie; his children, Joan, Jeannine, and Frank; his step-children, Kristin, Stephanie, Connie and Carol; and four grandchildren.



**TODD C. STORER II** '47 of Tulsa, OK, died on Dec. 19, 2006. Born in Pueblo, CO, he served in the U.S. Army during World War II. After earning his degree in petroleum engineering from Mines, he went to work for Standard Oil until his retirement. He vacationed often in Colorado, and he loved trout fishing, camping, gardening and sailing. He is survived by two daughters, Vivian and Nancy; and four grandchildren. He was predeceased by his wife, Doris and son, Todd III.

**ALAN R. STRINGER** '73 of Libby, MT, died on Feb. 24, 2007 in Oak Harbor, WA. Born in Bonne Terre, MO, in 1944, he was the oldest of five siblings. At a young age, he moved from Missouri to Leadville, where his exposure to the mining industry set the course for his life. After high school, he served in the Air Force for four years. He met Donna Parker shortly after his return to the U.S. and they were married in 1967. After receiving his degree in mining engineering, he worked for Alcoa in Suriname, South America; Leadville, CO; Ottawa, IL; and then Libby, MT. In Libby, he took a management position with W.R. Grace in 1981, working his way up to become general manager of their vermiculite mine. When the mine was closed down, he headed up reclamation efforts before moving to San Juan Capistrano, CA, again with W.R. Grace. At the end of this period, he was asked to return to Libby to manage the relationship between W.R. Grace, the community of Libby and the Environmental Protection Agency. Serving in this difficult position with integrity and honesty, he earned the respect and admiration of many. An active member of the Libby community, he served the local Catholic parish,

and was on the board of directors at St. John's Lutheran Hospital. He is survived by his wife, Donna Parker; his daughters, Ann Marie Hadley and Dana Brennan; his mother, Joan Stringer; siblings Jonny Stringer, Deborah Hildebrand, Kevin Stringer and Kim Herrera; and four grandchildren.



**VESPER A. VASEEN** '39 of Lakewood, CO, died on March 28, 2007. Born in the Denver area, he completed his degree in metallurgical engineering at Mines before taking the position of assistant sanitary engineer for the State of Colorado. He joined the U.S. Army in World War II and served until 1946 as a sanitary engineer at two Army bases. Leaving the Army with the rank of major, he went to work for a private engineering firm in Denver, where he was responsible for drawing up the original plat for what became the city of Thornton. He later platted a number of other town sites and subdivisions in the Denver area, and developed several water and sanitation districts. In 1966 he took a position with Stearns-Roger as a project engineer, where he nurtured his talent for invention. While at Stearns-Roger he filed a voluminous number of patent disclosures on a wide variety of subjects including lasers, solar power, odor scrubbers and auto emissions control. In 1980 he founded AVASCO Consulting Engineers and devoted himself full time to his inventions. In the years that followed, he successfully developed new technologies in fields as far ranging as mining, power generation, medicine, educational games and brewing. He also authored more than 70 articles and technical papers—his personal papers and notes were donated to the School in 1996. He is survived by his wife of 66 years, June Novak Vaseen; his daughter, Gail Vaseen Hardesty; his son, Dale Vaseen; two granddaughters; two step grandsons; and a great-granddaughter.



**WALTER W. WEID** '54 of Spokane, WA, died on Feb. 17, 2007. He was born in Denver in 1928, remaining in the area until graduating from Mines with a degree in geological engineering. After serving in the U.S. Army during World War II, he spent 25 years in the mining industry as a geologist, mining engineer, mine superintendent and environmental engineer. After retiring from the mining industry, he became a private businessman with a Duraclean Carpet and Upholstery Cleaning franchise. When he retired from carpet cleaning, he bought a series of vending machines "to keep busy." Walt was a member of Our Lady of Fatima Catholic Church. He was ordained a Permanent Deacon in 1985, and served in the Fatima parish and in prison ministry. He was active in right-to-life issues, and was a longtime member of Toastmasters International. Walt and his wife, Velda, were married for almost 55 years. They were active in Marriage Encounter for 30 years. Walt is survived by his wife, Velda; six children; twelve grandchildren; three great-grandchildren; and by his sister, Joelle Weid.

## Also In Memoriam

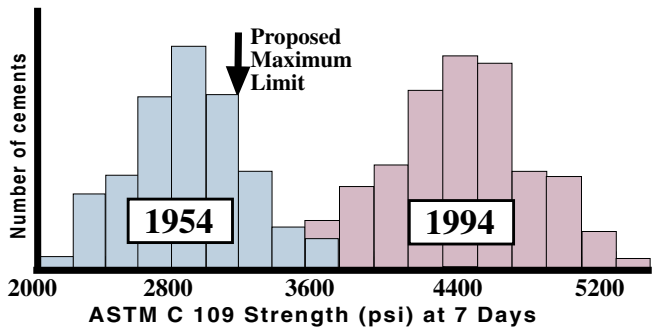
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**Edward D. Moore** '57 .....Aug. 11, 2006

**John F. Nutter** '49 .....Jan. 14, 2007  
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**Terrance S. Rouse** '64 .....Aug. 19, 2006  
**Charles C. Stewart, Jr.** '51 .....Nov. 23, 2006  
**Marvin S. Walker** '36 .....May 4, 2006  
**James G. Watriss** '72 .....June 24, 2003

## How I Tried To Prevent the T-REX Bridges from Cracking

By R. W. Burrows '43



In the construction business, doing something right the first time saves money over the long term. Over the last 50 years, pressure from contractors for faster-setting concrete has led to incremental compromises in quality. In 1995, R. L. Blaine published his 1994 survey of 387 North American cements. Compared to Blaine's similar 1954 survey, there has been a great increase in the early strength—this is bad, because greater early strength increases the risk of cracking.

After writing more than 30 concrete-related papers based on 50 years of experience in the business, I know the subject well. Which is why, when T-REX was approved back in 2001, I took a keen interest in their concrete specifications. Concerned about the use of fast-setting concrete, I wrote a letter to Gov. Bill Owens warning him that the 16 new bridges of the 1.6-billion-dollar T-REX project would have a cracking problem unless a slow-hydrating Portland cement was used. My letter was answered two months later by a Colorado Department of Transportation materials engineer who explained that the risk of cracking would be controlled by adding fly ash to the concrete mixture. On July 30, 2002, Franklin St. Bridge was the first T-REX bridge to open—within three months, it developed 260 cracks even though 15 and 20 percent fly ash was used and the concrete was placed at night.

In Sept. of 2002, Sen. Ben Nighthorse Campbell sent a letter at my behest to Norman Mineta, Secretary of Transportation, warning of the cracking risk to the remaining bridges. In Nov., the letter was answered by the associate administrator for

infrastructure, Federal Highway Administration, who said that the cracking problem was related to a design problem, not the cement. They reduced the spacing of the construction joints in the sidewalk from nine feet to four feet. The barriers, which previously had no construction joints, were redesigned with joints spaced at four feet.

Now, as I write these words in April, 2007, it is obvious to all that these corrective measures did not work. All 16 bridges are currently cracked. I firmly believe the problem was the cement, not the design: The sidewalk cracks in the Washington St. Bridge are worse than the cracks in the sidewalks of the Franklin St. Bridge, which had to be removed and replaced; the four-foot barrier sections have cracked; the pillars show crazing from drying shrinkage and have been camouflaged with grey paint; and many decks are cracked.

My solution to this problem is a more crack-resistant cement, such as was used in the 1950s when CDOT built 232 bridges. The 149 bridges that remain in their original state have withstood the test of time—none are cracked. And a solution like this could be adopted—the cement committee for the American Society for Testing and Materials International (ASTM) may approve a new and more crack-resistant cement to be called Type VI. The proposed new cement has a maximum limit of 3200 psi on the 7-day strength. In 2003, only 45 percent of the 75-member committee voted for Type VI cement. But in 2004 the count was 61 percent affirmative, and in 2005, 78 percent were in favor. There are nine remaining negative voters and each one must be voted as non-persuasive by a two-thirds margin for the cement to be approved. The cracking of the T-REX bridges has significantly strengthened the case for the proposed Type VI cement, so while it has been costly for our region, it may be good for the national interest. Perhaps the best news is that the Federal Highway Administration has reversed its position and is now supporting the effort for a more crack-resistant Portland cement.

For more information, please contact Dick Burrows at [Burrows340@aol.com](mailto:Burrows340@aol.com)

*Last Word* is a place for members of the CSM community, past and present, to voice their opinions on subjects of their choosing. The opinions expressed are not necessarily those of Mines magazine or Colorado School of Mines. Please consider submitting your own essay, or responding to this submission by sending email to [magazine@mines.edu](mailto:magazine@mines.edu).

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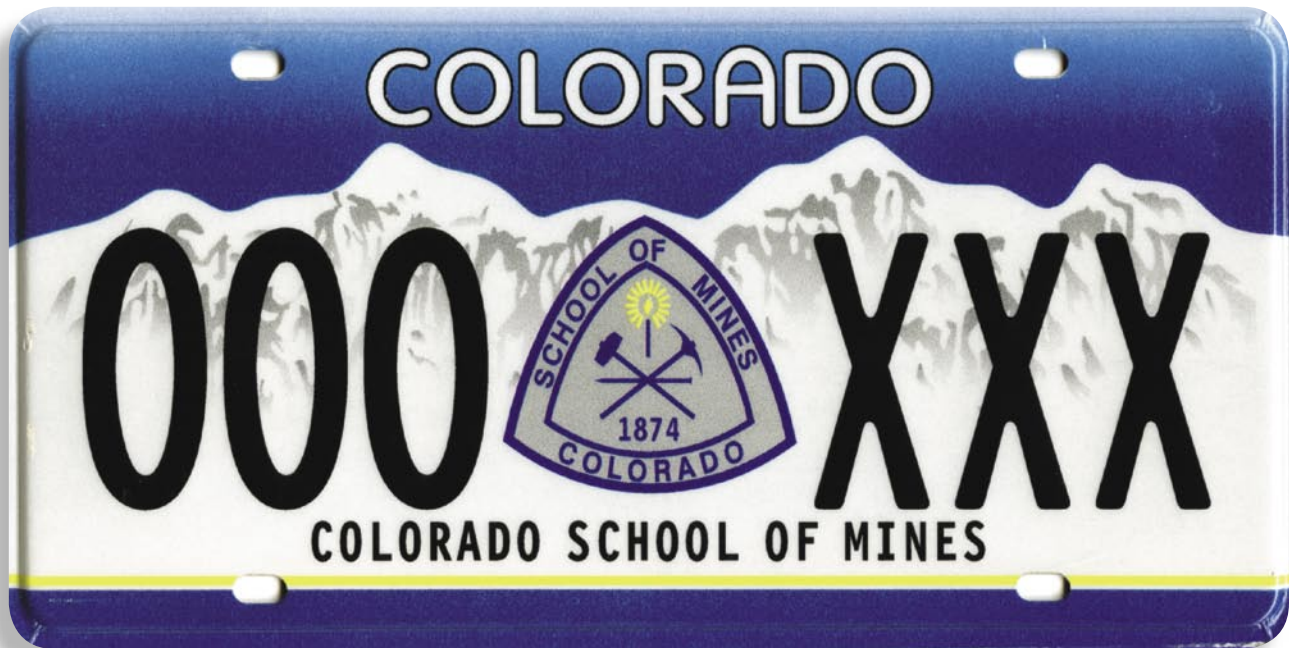
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