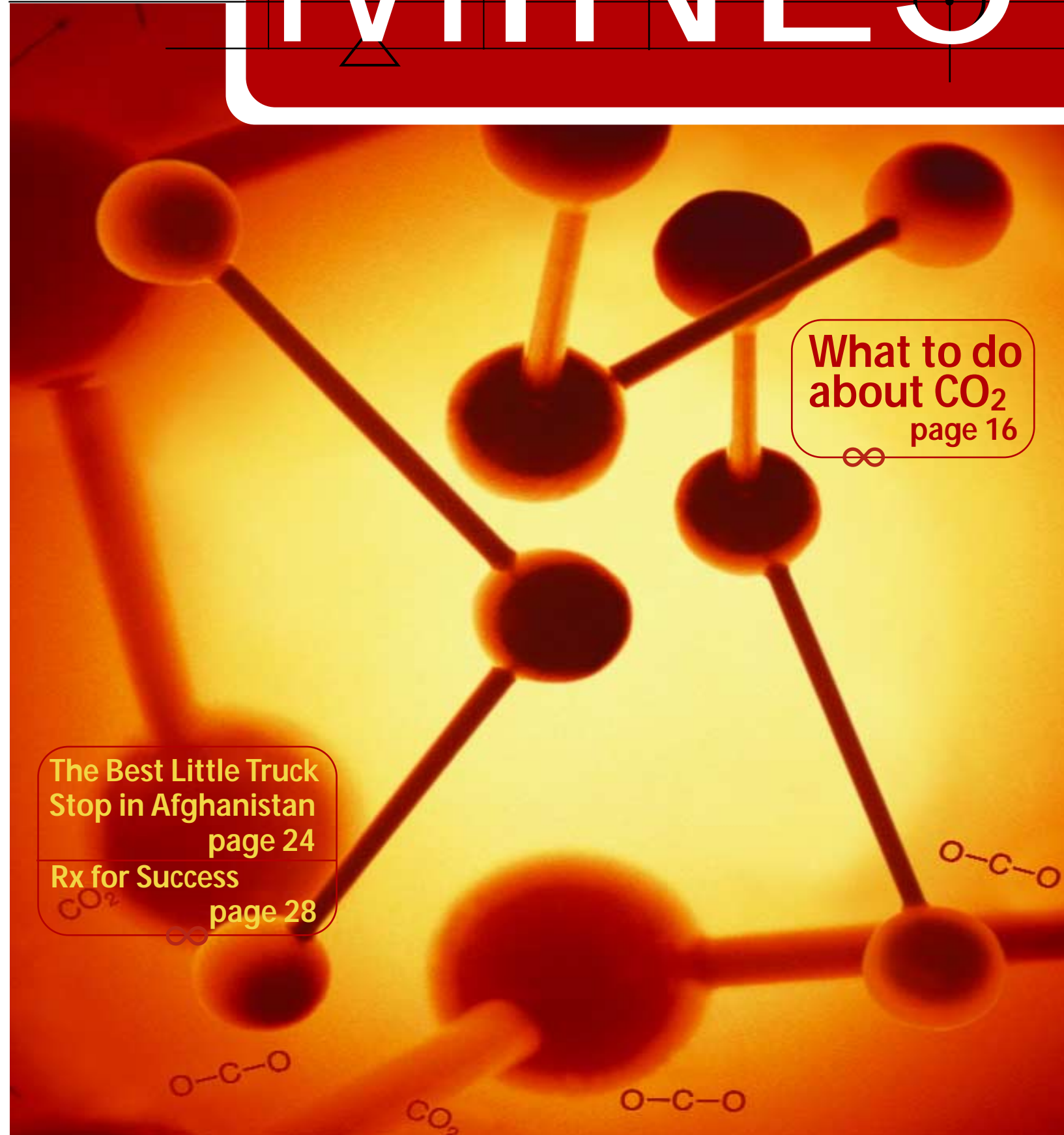


MINES

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Spring 2005

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- Proceeds benefit the CSM Alumni Association
- Sponsorships available:
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For information, to register, or to volunteer,
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- Dress code: Collared shirts are required with
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tank tops, cut-offs or ragged jeans.



MINES SPRING 2005

Mines is published quarterly by the Colorado School of Mines and the CSM Alumni Association for alumni and friends of the School. The magazine is a merger of *Mines Magazine* (founded in 1910) and *Mines Today* (founded in 1986). The merger took place in 2000.

Comments and suggestions are welcome. Contact us by writing to MINES, P.O. Box 1410, Golden, CO 80402; or call 303-273-3294 or 800-466-9488, ext. 3294 between 8 a.m. and 5 p.m. M-F MST; or email magazine@mines.edu

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Letters to the Editor

The Band Plays On

I was delighted to see the article on pages 28 and 29 of the winter 2005 *Mines* magazine on the CSM band. I was student director of the band in 1957-1958. My description of our non-traditional uniform allowed my wife to sit up and notice when the band appeared briefly on "Extreme Makeover."

The only difference I detected from our appearance in 1957-58 was the hard hats – we still used the traditional style with brim all the way around. I hope that nighttime performances are still assisted by carbide lamps attached to the hats. They were great for torchlight parades. I impressed my somewhat more musical children by telling that our principal concert appearance was for the Sowbelly Dinner of the Colorado Mining Association. One more thing – in those years, when the undergraduate female attendance of CSM maxed at six, the band was all male – but the largest man in the band played clarinet, and the smallest was the bass drummer!

Musically yours,

Clarence B. (C.B.) Drennon, Geol.E. 1958
Fairlawn, Ohio

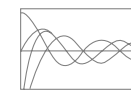
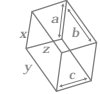
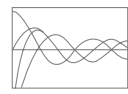
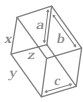
Do You Remember the Astor House?

The Astor House in Golden was purchased by Ida Goetz at the turn of the 20th century and was run as a boarding house until 1950. Now a museum, the history of the house is being researched by volunteers. We have a particular historical interest in the 1867 to 1908 time period. We would like to identify the text books being used and the nature of the classes at the School. For instance, we would like to be able to say, here is what Mines students did in 1905. Any students who had a relationship either as a resident or boarder at the Astor House in any time period could be of significant help. Please contact me if you have any stories to relate.



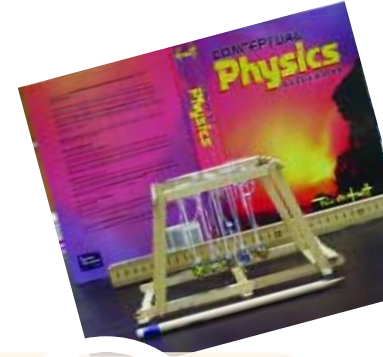
Thank you.

Charles Amen,
Astor House Volunteer
amenc@aol.com
720-870-1800



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The best little truck stop in Afghanistan



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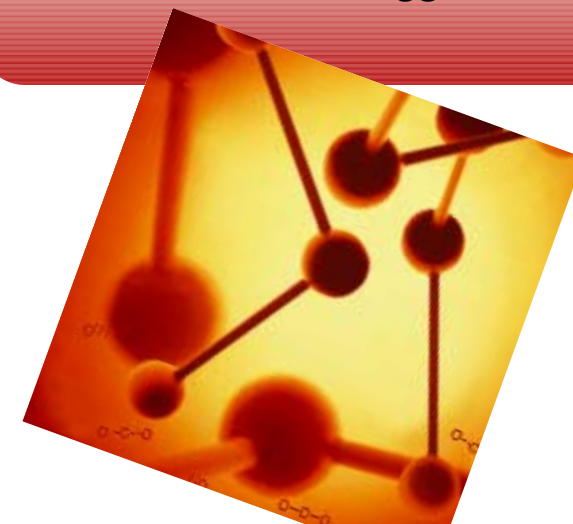


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Alumni in the medical professions say Mines was a prescription for success

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About Our Cover:

The cover depicts CO₂ molecules, part of the Earth's problem when viewed as greenhouse gases, but also possibly part of the solution if harnessed and used to reclaim more fossil fuels. Read more about it in "Peak oil and global warming – is there a common solution?" on page 16.

MINES CHALKS UP INTEREST IN MIDDLE SCHOOL MATH

By Karla Gordon

The effort to mold future scientists, mathematicians and engineers begins early and Colorado School of Mines is helping with the effort. As a former director of the National Science Foundation (NSF) said, "We cannot expect the task of science and math education to be the responsibility solely of K-12 teachers while scientists, engineers and graduate students remain busy in their university laboratories." Over the past three years, four projects at Mines, funded by the NSF, the Colorado Commission on Higher Education, the Colorado Department of Education and others, have focused on providing middle-school teachers with instruction in mathematics and science in order to improve the educational experiences of middle-school students. The goal is to help teachers develop hands-on classroom learning environments that illustrate how mathematics can be applied to earth science and engineering.

Each of the four projects holds eight- to 10-day workshop sessions designed around a theme and that demonstrate hands-on activities to illustrate the value of math and science in real-world problem solving. **Cathy Skokan BSc Geop '70, MSc Geop '72, PhD Geop '75**, one of the program directors, says that in the real world, math and science always work in concert. The activities for participants include building bridges out of Popsicle

sticks, re-engineering a diaper, designing a water filtration system using sand, learning how to do an energy audit and inventing musical instruments. At the end of the workshop, each participant receives \$500 to purchase supplies to take back to their schools. Teachers then use ideas and materials from the workshops in their middle-school classrooms.

Professors Barbara Moskal and Skokan direct and coordinate the workshops, but they've recently delegated the responsibility of teaching the workshops to graduate fellows. Doing so allows them to travel and present the project at conferences in an effort, Moskal says, "to share our methods and results with respect to K-12 outreach with our national and international colleagues."

Last year, the professors went to Florida, Utah, China and India; this year

they'll go to Oregon, Australia and Poland. In addition, graduate students promote the program by making presentations about the workshops at national conferences.

All of the projects also include follow-up classroom visits from CSM faculty or graduate students in which the teachers receive assistance in implementing hands-on mathematics and science instruction. In the *GK-12 Learning Partnership* project, graduate students provide direct support in the classroom to a given teacher for 10 to 15 hours each week. In the *Physical Science & Mathematics* project, students provide help in the classroom for one hour every other week. The appropriate amount of support needed is currently being scientifically analyzed.

Keith Hellman, one of the CSM graduate students who spends time in several schools each week, says the most exciting aspect of the experience is that "students can ask very insightful and very motivated questions."

Hellman has been surprised, he says, "by how much work it takes to be a good teacher and how much pressure teachers are under to

show progress on assessments. Our culture does not do enough to reward, encourage and assist the people who, arguably, have the most influence over our future."

Skokan explains that middle schools rather than high schools were chosen as partners because middle-school teachers often don't hold degrees in the subjects they teach, so they may lack content knowledge. These teachers need an opportunity to learn and understand the concepts they are required to teach. Further, research shows that middle school is a crucial time for kids. Moskal, the *GK-12 Learning Partnership* project director, says that it's during the middle-school years that students may opt out of the academic classes that are prerequisites for advanced science and mathematics courses in high school and beyond. "Students from low-income families are at an even greater risk of displaying weak mathematical and scientific knowledge when compared to their middle-class peers," Skokan adds. To increase the number of students who continue their education into higher mathematics and science, she says, "It's important to provide activities that excite students. By showing kids that there are meaningful, real-world applications, we stand a better chance of not only holding their interest, but also that they might pursue



math and science into their adult lives.”

The project includes a number of tools to determine whether or not it is effective. Participating classroom teachers take tests before and after the workshops and also provide daily feedback. Mines faculty meet regularly with teachers in focus groups and there is also an independent evaluator from the University of Colorado School of Education. Also, there will be Colorado Student Assessment Program (CSAP) data to indicate the impact of these programs. **Agata Dean BSc Eng '04**, a graduate fellow involved in the project, plans to write her master's thesis on the effect of these programs on CSAP scores. Students Leanne Miller and Tina Ziemek are focusing their master's theses on educational projects that are designed to improve middle-school students' learning of mathematics and science.

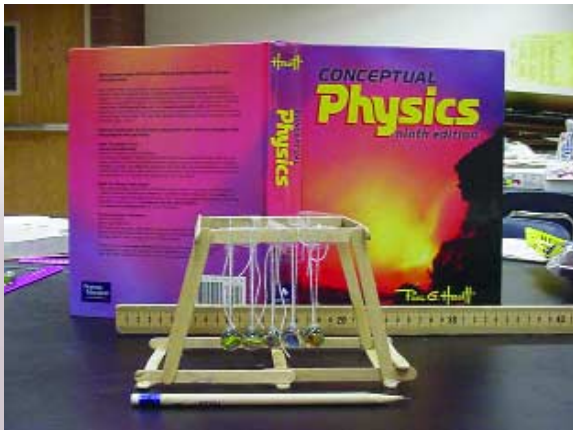
Moskal and Skokan believe the benefits of the project are far-reaching. In addition to some 5,500 young students they estimate



the project has reached, CSM graduate students also get an opportunity to improve their verbal communication skills both in teacher workshops and in the classroom. While the Mines students are offering valuable materials and knowledge to classroom teachers, in return, they are gaining pedagogical knowledge and teaching experience, which is

important because many of the participating graduate students are considering careers in education. Graduate students Leanne Miller and Michael Ewing also have learned to write grant proposals to fund and develop technology camps for middle-school students. Miller and **Tamera Hockett BSc Eng '04** have been successful in assisting the participating teachers in writing grant proposals for classroom supplies. At least three of the student-written proposals have been funded so far. Perhaps more importantly, as Keith Hellman points out, “the most rewarding aspect is simply the opportunity to help.”

Karla Gordon is a freelance writer in Evergreen, Colo.



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At the request of legislators, Mines football players sang "The Mining Engineer" during their visit to the State Capitol.

From Brooks Field to State Capitol

Members of Colorado's Senate and House of Representatives extended their "heartiest congratulations" to

the 2004 Mines football team at the State Capitol in February. The official commendation cited the Orediggers for:

- Completing their best season in School history and winning their

- first conference championship since 1958
- Finishing the regular season undefeated and advancing to the NCAA Division II playoffs
- Having Head Coach Bob Stitt honored as the 2004 Division II



American Football Coaches Association Regional Coach of the Year in Region 5, and the *d2football.com* Southwest Regional Coach of the Year

- Having quarterback Chad Frieauf win the 2004 Harlon Hill Trophy as the top player in Division II, with the single season record for completion percentage and total offense.



International Recognition for Illangasekare

Tissa Illangasekare has been named a Fellow of the American Geophysical Union (AGU), an

international society that advances the understanding of Earth and space for the benefit of humanity. AGU has more than 41,000 members in over 130 countries. Illangasekare, the Amax Distinguished Chair in the Division of Environmental Science and Engineering, will accept the honor and certificate at the AGU meeting in New Orleans in May. Each year no more than 0.1 percent of the AGU membership may be elected Fellows.

In addition, the Asian Institute of Technology has selected Illangasekare as a member of its Academic Advisory Panel, comprised of up to 18 eminent academics from around the world.

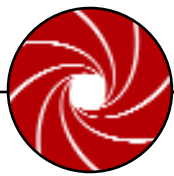
Mishra Named Fellow

Brajendra Mishra has been named a Fellow of ASM International, The Materials Information Society with a worldwide membership of 36,000.

Mishra, a professor in the Metallurgical and Materials Engineering Department, was cited "for distinguished contributions to education and research in high temperature electrochemical and pyrometallurgical materials processing, and for outstanding achievements in adoption of surface engineering technologies for improved tribology."



Past ASM President Robert C. Tucker Jr. (left) and Brajendra Mishra



SHORT STAKES

Toilers Tackle Mobile Networks

The Toilers, a mathematical and computer sciences research group of four professors and approximately 15 students, currently has five National Science Foundation (NSF) grants, all concerning various aspects of mobile networks. Last fall Professors Tracy Camp and Mike Colagrosso BSc Math & Comp Sci '99 organized two NSF-funded meetings related to the networking of sensor systems focus area at NSF.

Simulation code (10 different packages) developed by members of the Toilers has been requested from and shared with more than 280 researchers at 189 research labs and universities in 34 countries.



The Mathematical and Computer Sciences research group known as The Toilers

Energy Mission

Dag Nummedal, director of the Colorado Energy Research Institute at Mines, and Board of Trustees member David Wagner accompanied Colorado Governor Bill Owens,



Dag Nummedal

Denver Mayor John Hickenlooper and others on the 2005 Colorado-Alberta Energy Partnering Mission to Calgary in April. The delegation met with Canadian companies and government officials to encourage partnership and investment opportunities in Rocky Mountain energy and technology.

All Dressed Up, Someplace To Go

For area high schools girls who couldn't afford a prom dress this spring, Mines women looked in their closets and found more than 50 formal evening gowns to donate to the local 6th Annual Prom Dress Exchange. CSM's assistance with the project was sponsored by the Diversity Committee in honor of Women's History Month.



From left, Rachel Arnett, a chemical engineering freshman, and Kim Kilmer, a mechanical engineering senior, donated gowns to a prom dress exchange.

Student Chapter a GEM

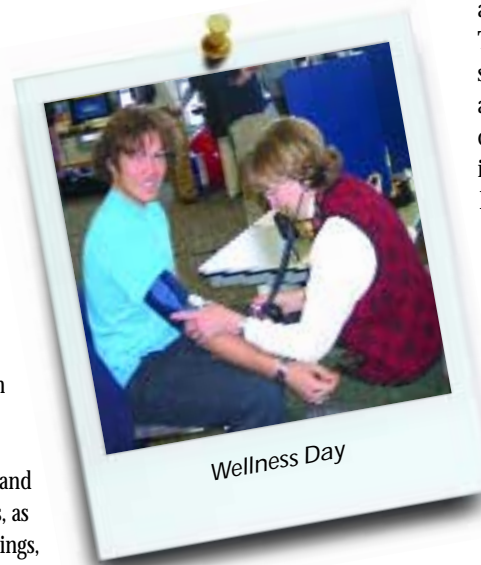
Mines' student chapter of the Society for Mining, Metallurgy, and Exploration (SME) was awarded the Government, Education and Mining (GEM) award in February at the SME annual conference. To increase the public's awareness of mining-related industries, students:

- Visited elementary schools and gave tours on campus
- Participated in E-Days competitions
- Gave tours of CSM's experimental Edgar Mine in Idaho Springs.

To Good Health!

Mines hosted its 15th Annual Wellness Day in March at the Ben Parker Student Center. This year's theme was "The Five Dimensions of Wellness: Physical, Emotional, Spiritual, Social and Intellectual."

Visitors to the event, which featured 35 local vendors, had the opportunity to gather health information and meet local wellness experts, as well as benefit from screenings, demonstrations and giveaways. Topics included massage, acupuncture, outdoor activities and fitness, emotional health, body fat testing and healthy eating.



Wellness Day

Homework Help

Members of Phi Gamma Delta fraternity are volunteer tutors for

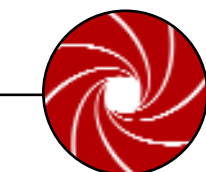
area students in grades one to 12. They provide help in all classroom subjects. Fraternity members are available for homework consultations two afternoons a week in the children's room of the Golden Public Library.

SWE-ET Deal

The Mines student section of the Society of Women Engineers (SWE) has received a \$2,000 grant to increase their outreach to students in local middle schools. Their project, called SWE-ET Links (SWE-Engineering and Technology Links), will be funded by the ExxonMobil Program Development Grant. In their request to the national SWE Program Development Grants Committee,



SWE members, from left Sara McFarland, Laura DeHerrera and Jessica Nekuda, make liquid nitrogen ice cream.



To see images of asteroid Kenlarner, go to: sepwww.stanford.edu/oldsep/joe/Astro/Named/KL.html.



A streak image of Kenlarner shows the asteroid moving among the fixed stars.

Dellinger describes the asteroid as "a chunk of rock approximately two kilometers across," and explains that it "generally takes about four years of following an asteroid before it becomes permanently numbered and eligible for naming."

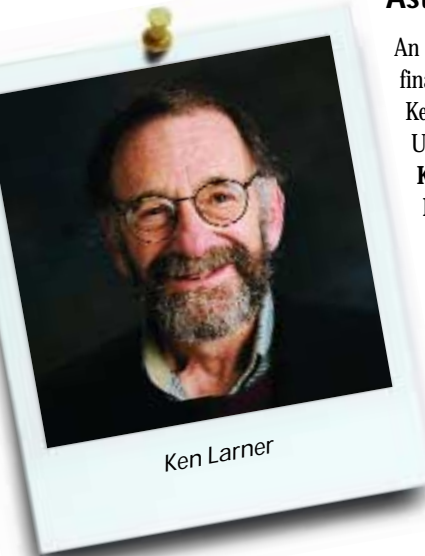
In the official citation to the Committee on Small Body Nomenclature, the international body of astronomers that approves proposed minor planet names, Lerner is described as a "world-renowned exploration geophysicist recognized for his quiet leadership skills."

Asteroid Kenlarner

An asteroid discovered in 2001 finally has a name. It's Kenlarner, in honor of University Emeritus Professor **Kenneth L. Lerner GeopE '60, PhD Geop '70** who retired in 2004 from Mines after serving for 16 years as the Charles Henry Green Professor of Exploration Geophysics.

Joe Dellinger and William G. Dillon, geophysicists and members of the Fort Bend (Texas) Astronomy Club,

discovered asteroid Kenlarner at the George Observatory in Brazos Bend State Park, Needville, Texas.



Ken Lerner

showcased artwork, including the unveiling of a mural titled "Man vs. Nature and Technology," as well as music and poetry readings.

Dust a Real Danger to Space Missions

Dust is more than a housekeeping challenge for space exploration missions to the moon and Mars.

Apollo moon missions revealed the existence of dust resembling volcanic ash, which penetrated sensors, door seals, spacesuits, science samples and spacecraft machinery. Significant problems with dust have also caused motor bearings to fail on Mars rovers. With no method of reducing the

effects of this dust for future missions, extended stays on the moon or Mars would be at risk.

Researchers at the Space Research Partnership Center at Mines have been awarded a \$14.6 million contract to work with three NASA centers, five universities, and seven industry partners to meet the dust challenge. Masami Nakagawa, associate professor in the Mining Engineering Department, heads the project, focusing on special technology for spacesuits,



vehicles and manufacturing plants in space. Methods of sensing, characterizing and mitigating dust will be tested in a cryogenic vacuum system at Mines.



From left, Masami Nakagawa, Gary Rodriguez and Nicole McGee will head project for NASA.



Lydia Muwanga, a senior majoring in engineering, helped organize the spring art show.

Art Show

"Captured Creativity," the spring art exhibition held at Arthur Lakes Library, was sponsored by the Creative Arts Club. The event

SHORT STAKES

Then and Now—and How!

Marvin L. Kay EM '63 emeritus professor of physical education and athletics, delivered the Faculty Senate Distinguished Lecture in February. "Mines Athletics and Academics, Then and Now—and How!" emphasized that striving for excellence in athletics not only impacts the educational experience of individual students, but also elevates and broadens the reputation of the entire institution.

The Faculty Senate Distinguished Lecturer Award, established in 1990, gives the Mines faculty the opportunity to annually recognize one of their outstanding colleagues.

They select a lecturer admired and respected as an educator, as well as a person known for having stimulating ideas to convey and an ability to communicate those ideas effectively.

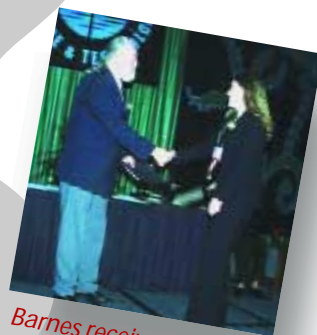
Kay retired in 2004 as director of athletics, a position he had held since 1995. From 1969 to 1995, Kay was the Oredigger head football coach, and he is the all-time winningest coach in School history with 84 wins. In addition to the Faculty Senate Distinguished Lecturer Award, Mines has also honored Kay with a Mines Medal in 2003, and the Alumni Association named Kay "Outstanding Alumnus" in 2002.



From left, Faculty Senate President Sam Romberger and Marvin Kay.

Graduate Student Takes Top Honors

Last fall, the student research of **Teresa Barnes PhD CPR '04** was recognized as the top graduate research within the AVS Semiconductor Division at the 51st International Symposium of the American Vacuum Society (AVS). In December, she was among 30 graduate students at the annual meeting of the Materials Research Society (MRS) invited to compete for an additional award before a blue ribbon evaluation panel. Based on a presentation of *p*-type conductivity in nitrogen-doped zinc oxide thin films, Barnes was selected as one of the top seven graduate students to receive the MRS' prestigious Gold Award. She is the first CSM student to win such an award.



Barnes receives an award from AVS president Robert Childs.

Bickart Named ABET Fellow

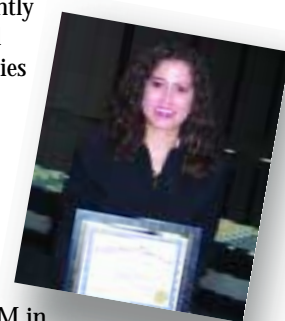
Ted Bickart Hon Mem '99, CSM president emeritus, received a 2004 Fellow of Accreditation Board for Engineering and Technology (ABET) award. He was honored for his leadership within the Institute of Electrical and Electronics Engineers (IEEE) for accreditation activities, for his contributions to the integration of computing programs into ABET and for his lengthy service as a program evaluator and member of the Engineering Accreditation Commission (EAC). Bickart is currently an alternate member of the EAC and active in ABET's international activities as a program evaluator.



Ted and Frani Bickart in Chiang Mai, Northern Thailand last fall.

Trujillo '00 a Rising Star

Chontel M. Trujillo BSc CPR '00, an environmental/chemical engineer and project manager for IBM in Boulder, Colo., was recently recognized in *Women of Color Magazine* (Nov/Dec 2004 issue) as a "2004 Rising Star of Technology." The award was presented at the Women of Color Technology Conference in Atlanta at a national industry convention that recognizes the contributions of accomplished



multicultural women in the fields of math, science and technology. Rising Stars are women of color under aged 30 who are helping shape technology for the future.

Trujillo's responsibilities include analytical analysis of industrial wastewater, sanitary sewer, cooling tower and stormwater for permit and regulatory requirements; serving as an environmental focal contact; hazardous waste identification and minimization; program management for environmental awareness and performing environmental audits at IBM locations across the United States. Trujillo also holds an MBA from Regis University.

Mollison '58 Inducted into Hall of Honor

Jim Mollison Geol E '58 was inducted into the South Dakota Highway Hall of Honor in 2004. During the 20 years he worked in the transportation industry, Mollison left a lasting and valuable contribution by continually promoting highway funding, communication, cooperation, legislation and professionalism. He actively promoted and hosted annual gatherings and meetings of both the American and Western Associations of State Highway and Transportation Officials for the purpose of improving communication and relations between Department of



Transportation officials in South Dakota, North Dakota, Wyoming and Montana. His efforts facilitated the development of a multi-state group called the Bread Basket Coalition, which resulted in a significant improvement in the formula share of federal highway funds going to each of the states in the coalition. This improvement first occurred in the late 1980s, but continues to affect highway bills to this day.

N.A. Tech. Inc. Commercializes Technology

Native American Technologies Company (N.A. Tech. Inc.), a Golden, Colo., Native American-owned and operated small business, has received the Outstanding Phase II Transition Award. The award is presented annually to small businesses that achieve success in commercialization of technology developed in a Navy-funded Small Business Innovation Research (SBIR) project. N.A. Tech. Inc. is one of 13 companies nationwide to be so honored. **Jerry Jones BSc Math '71, MSc Math '74, PhD Met '79** is the company's chief technology officer. He taught at CSM for 17 years before helping to found N.A. Tech. Inc. The company has turned its knowledge about weld distortion into a technology for bending metal into shapes without using any applied force. The award was presented by Dawnbreaker Company, which provides business advising to Navy SBIR Phase II recipients under a contract from the Office of Naval Research.



Mullinax '47 Publishes WWII Memories

James A. "Pete" Mullinax Geol E '47 has recently published *Foes by Fate... Friends by Choice*, an account of his experiences in World War II. Mullinax was a B-17 pilot during one of the most intense air battles of the war. He was shot down and became a prisoner of war in Germany. Mullinax not only survived, but made friends with many Germans. As he says, the book "demonstrates the significance of the horrors of war and the ability to be at peace – not only with yourself – but with those who were fighting against you. This is the miracle and gift of humanity."



Spencer R. Titley

Titley '51 and McNulty '67 Earn High Honors

Spencer R. Titley Geol E '51, an economic geologist internationally known for his work on the origin of porphyry copper deposits, and **Terry McNulty DSc Met '67**, president of T. P. McNulty & Associates Inc. and a leader in mineral processing hydrometallurgy, were elected to the National Academy of Engineering (NAE).



Terry McNulty

Election to the NAE is among the highest professional distinctions accorded an engineer. Titley and McNulty are among 74 new members and 10 foreign associates recognized this year for outstanding contributions to engineering research, practice or education. Those elected this year bring the total U.S. membership to 2,195.



Raymond L. Lowrie

Three Alumni Receive SME Awards

Raymond L. Lowrie MSc Min Ec '72 was presented with the Society of Mining, Metallurgy and Exploration's President's Citation "for leading SME's Professional Registration Committee through its most challenging years and for editing SME's award-winning, best-selling *SME Mining Reference Handbook*. The handbook was recognized in 2004 as an Outstanding

Academic Title by *Choice Magazine*, a publication of the American Library Association.

Anthony K. Staley BSc CPR '97, MSc Eng & Tech Mgmt '02, PhD Met & Mat Eng '02 was named the SME's Mineral and Metallurgical Processing Division's Outstanding Young Engineer. After receiving his PhD from Mines, Staley joined Newmont Mining's technical services team as a senior metallurgist. He provides technical support for processing facilities and metallurgical testing and process development of new ore bodies.



Anthony K. Staley



F. Steven Mooney

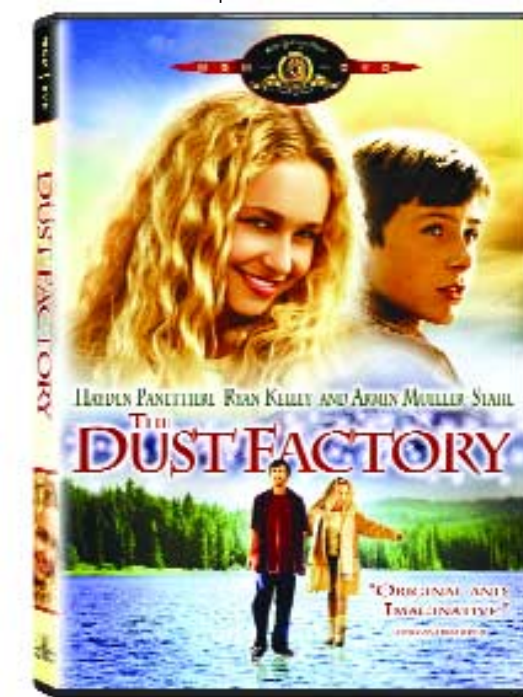
F. Steven Mooney Geol E '56 was awarded SME's William Lawrence Saunders Gold Medal recognizing distinguished achievement in mining other than coal. Mooney is CEO of Thompson Creek Metals Company in Colorado. He has also served on the CSM Board of Trustees.

The family of alumnus **John P. Lockridge '52** was involved in writing and directing this Hollywood motion picture. Erika Lockridge, dedicated Mine's supporter and John's wife, executive produced the movie.

The movie is now available

on DVD at your local media store or through www.amazon.com

<<http://www.amazon.com/>>



Peak oil and global warming – is there a common solution?

By Dag Nummedal
 Director of the Colorado Energy
 Research Institute (CERI) at Mines

Energy issues appear daily in newspapers, magazines and television news across the nation and the world. It didn't use to be that way; rather, abundant cheap energy supplies were generally taken for granted with only intermittent disruptions, such as the Arab oil embargo in the '70s and occasional power failures such as the black-out in some Great Lakes states and adjacent Canada two years ago. Today, however, our nation's and the world's attention is focused on the imbalance between the rate of new hydrocarbon discoveries and the rate of production, making many predict that a global peak in oil production is just around the corner. Equally disturbing is the geographic imbalance between the location of the world's major oil and gas supplies and the largest markets, with attendant security concerns. Finally, the direct linkage between increases in global temperature and industrial production of CO₂ has now been demonstrated beyond any

mourn the defunct Kyoto Protocol, we should start taking the small steps to reduce carbon dioxide emissions today that can make a big difference down the road. The private sector already understands this and its efforts will be crucial in improving fossil fuel efficiency and developing alternative sources of energy. To harness business potential, however, governments in the developed world must create incentives, improve scientific research and forge international partnerships." Similar views are also expressed by Lord Oxburgh, chairman of Shell. "No one can be comfortable at the prospect of continuing to pump out the amounts of carbon dioxide that we are pumping out at present...with consequences that we really can't predict but are probably not good."

CO₂ emissions to the atmosphere can and must be reduced to mitigate global warming. Removal of some atmospheric CO₂ can be aided by planting trees and use of agricultural land management practices that more effectively retain carbon in soils. Also, it can be achieved by creating growing market demand for CO₂ in the oil industry. It is this latter approach that offers the greatest potential for linking climate change mitigation to increased recovery of oil from existing fields, hence a delay in the date of "peak oil."

A number of progressive energy companies already have engaged in production practices that use CO₂ as a means of extracting more oil from underground reservoirs. For example, here in the Rocky Mountains, ChevronTexaco has applied CO₂ for enhanced oil recovery (EOR, or IOR for "improved" oil recovery) at the giant Rangely Field in Colorado since 1986. Amoco began similar CO₂-EOR at Baroil in Wyoming in 1987 (Fig. 2; the fields are now owned by Merit Oil) and Anadarko began CO₂-EOR at Patrick Draw and Salt Creek fields in Wyoming in January 2004. In the

reasonable scientific doubt (Fig. 1). Prudent management of risks related to dislocations of climate-related economic activities requires mitigation against further rapid climate change.

These three problems are real and very serious, yet accelerated implementation of the proper technology and policy could greatly reduce their negative impacts. Industry understands that these issues are real, serious and – solvable. For example in 2004, Lord Browne, chief executive of BP, noted: "Global warming is real and needs to be addressed now. Rather than bash or

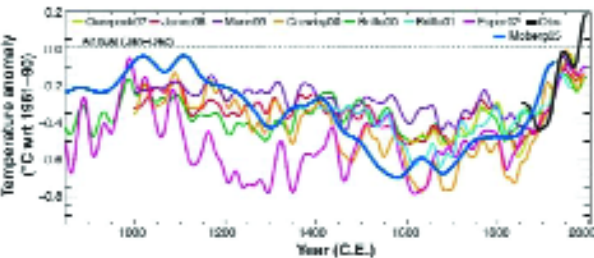
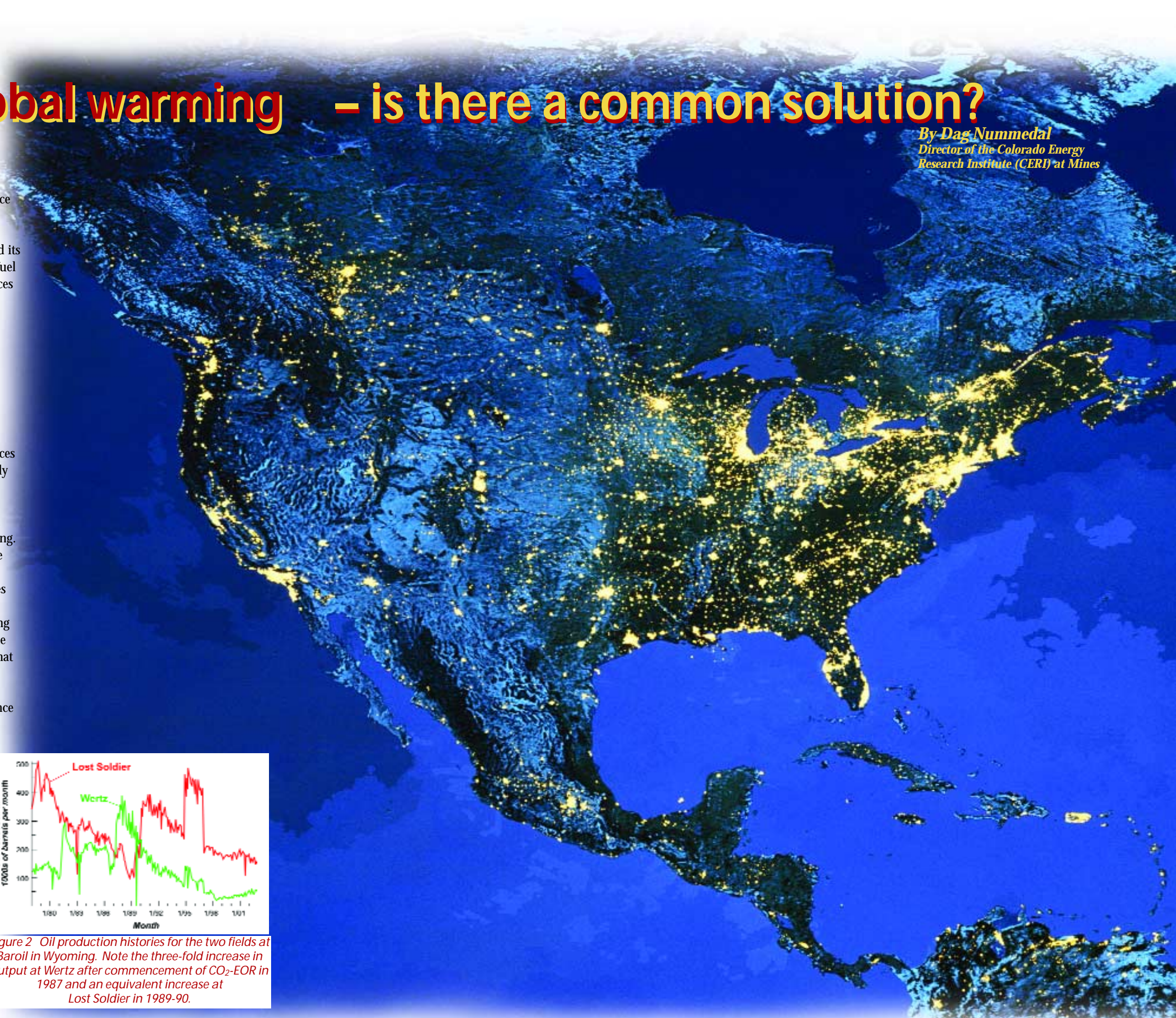


Figure 1 Temperature records since year 850 AD from 7 different studies published over the past 8 years. From: Kerr, 2005.



Figure 2 Oil production histories for the two fields at Baroil in Wyoming. Note the three-fold increase in output at Wertz after commencement of CO₂-EOR in 1987 and an equivalent increase at Lost Soldier in 1989-90.



Permian Basin of West Texas, there has been an active CO₂-EOR industry for about 30 years.

The value and the potential of CO₂-EOR are rapidly becoming recognized worldwide. For example, Jon Chadwick, chairman of Shell Malaysia, offered this vision at a recent IOR conference in Kuala Lumpur: "Producing the second half of the world's known oil reserves (originally at 2.2 trillion barrels of oil) will be significantly more challenging than producing the first. Therefore, the decade ahead will be IOR's finest hour – because it has to be."

A recent research forum organized by the Society of Petroleum Engineers made it very clear that we no longer can accept the past industrial practice of leaving about two thirds of the hydrocarbons behind in a reservoir at the end of its economic life. Industry recognizes that recovery factors of 70 percent or even 80 percent are technologically achievable. This goal is also becoming economically desirable – once all externalities related to the cost of energy production are honestly reflected in the commodity price. Moreover, increased research into the scientific foundations of CO₂-EOR (and other IOR methods) will gradually reduce technology costs for this industry.

The most promising technology for enhanced oil recovery on a global basis, I believe, is the use of CO₂ injected deep enough in the oil fields to achieve pressures sufficient for miscibility between

CO₂ and oil. There are many other EOR technologies in existence, but CO₂ has the unique advantage that curtailing its emissions into the atmosphere is a goal in itself. Ironically, in spite of this, further growth of the CO₂-EOR industry in the U.S. today is curtailed by the lack of CO₂! This is because the current industrial sources for CO₂ are underground natural reservoirs where CO₂ is separated from natural gas (methane) during the production process. In contrast, much larger quantities of CO₂ are released directly into the atmosphere from coal-burning power plants, other industries and automobiles. As an example, in Wyoming – a leading U.S. energy producing state – the production of CO₂ from the large natural gas field at LaBarge is about 10 million tons per year, whereas the release from the coal-burning power plants within the state amount to about 90 million tons per year. The 10 million tons of natural CO₂ are fully used for EOR operations within the Rocky Mountains fields listed earlier, whereas the 80 million tons of anthropogenic CO₂ are wasted. To further emphasize this irony, the map in Fig. 3 shows how the existing CO₂ pipelines in the central Rocky Mountain region run very close to several of the region's largest power plants. The current cost of separation of pure CO₂ from power plant flue gas and the cost of compression for deep subsurface injection are the primary factors holding back the use of anthropogenic CO₂ for EOR.

Several analyses of global trends in the use of primary energy sources conclude that coal will remain a major resource. We will continue to burn it, but hopefully in cleaner ways than in the past, such as through the use of integrated gasification combined cycle (IGCC) power plants.

Huge and rapidly developing economies, such as those of India and China, are presently increasing their energy consumption at rates of nearly 10 percent per year. They view the situation as having no choice but to continue exploiting their domestic sources of coal because of both economic and security reasons. At the recent World

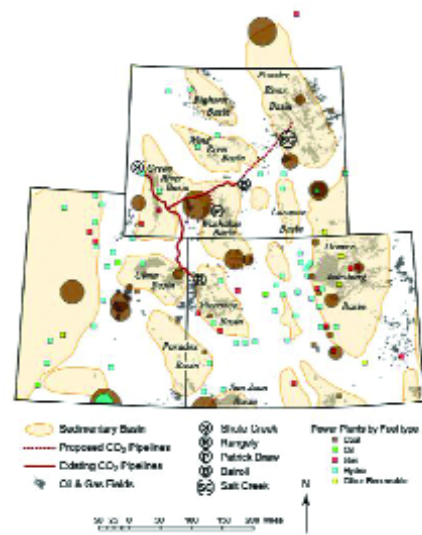


Figure 3 Map of CO₂ pipelines, power plants, sedimentary basins and oil fields in the states of WY, UT and CO. CO₂ emissions from the coal-burning power plants are proportional to the size of the "bubbles".

Energy Congress in Sydney, Australia, Kjell Bendiksen, director of the Institute for Energy Technology in Norway, emphasized this point by declaring that "the enormous short-term energy demand growth in the developing countries will, in all probability, be covered almost exclusively by fossil fuels. For that reason, the world needs to develop and deploy low-emitting technology on a very large scale." To achieve this "policy and fiscal mechanisms are generally overemphasized and the need for new technology is critically underrated."

Two of the largest energy issues identified at the outset were global warming due to CO₂ emissions and the declining rate of oil reserves replacement through exploration. The observations above make a strong case for coupling these issues via technological, economic and regulatory mechanisms because one problem is, in fact, part of the solution to the other. CO₂ is a resource that the world no longer can afford to waste by emitting it into the atmosphere. Business, government and the technology community need a change in mindset, where CO₂ no longer is considered only an undesirable greenhouse gas (which it is) to be put away (sequestered) at huge costs both in dollars and added energy consumption, but the potential driver behind a "revolution" in the world's oil production scenarios. A cap and trade bill, probably modeled after the pending McCain-Lieberman amendment to the energy bill, is one mechanism whereby the economic incentives for CO₂-EOR would grow through the added value of earned carbon credits. Similar approaches have greatly aided the world's effort to reduce acid rain.

For carbon credits to work, and to enable this proposed scenario to achieve significant mitigation of global warming, the source of CO₂ must, of course, be anthropogenic. The current practice in the EOR industry of using CO₂ that is co-produced with natural gas from subsurface reservoirs is economically attractive in today's business climate where the only added value is that of incremental produced oil. With proper accounting for the costs of global warming through the added value of carbon credit trades, however, anthropogenic sources would soon become the option of choice for the CO₂-EOR industry. Making such CO₂ sources attractive to industry is one of those "underrated technology needs" referred to in Bendiksen's quote above. A major research and development effort is needed now to produce pure CO₂ from flue gas at prices that are competitive with today's CO₂ delivered from underground gas reservoirs.

Challenges faced by new directions of industrial development are, of course, the life-blood of opportunity for engineering-oriented research institutions. Therefore, the Colorado Energy Research Institute (CERI), re-enacted by the Colorado Legislature in 2002, and its host institution, the Colorado School of Mines, face a unique opportunity to become major players in this emerging transformation in the global energy industry. The attitudes and skill sets needed to solve the many complex multidisciplinary science and engineering problems involved in this industrial transition are in abundant supply on our campus. The key attitudes relate to the faculty desire to work across traditional discipline boundaries, as witnessed by the many successful centers at CSM. CERI is structured to further enhance this cross-disciplinary collaboration by employing research faculty at key interdisciplinary nodes and pursuing governmental and industrial support for longer term, multidisciplinary projects. The on-campus skill sets in reservoir characterization, production optimization, drilling technology, CO₂ separation and energy economics make CSM the natural hub for research on key issues related to this transformation. CERI's strong linkage to the Gas Technology Institute, one of the institute's charter members (together with CSM and the Colorado Governor's Office of Energy Management and Conservation) further strengthens our hand in this R&D area. Also, CERI is a state institute hosted at CSM but linked also to University of Colorado and Colorado State University, who provide additional expertise in fields of environmental law, climate change science, CO₂ storage and economics issues, as well as skills in large-scale project management.

The very serious energy issues discussed above *do* have solutions. Two of the largest challenges, the declining rate of new oil discoveries and the increase in global warming due to unchecked CO₂ emissions, can and should be linked for the purpose of channeling market forces toward their combined solution. A significant part of that solution is the development of a worldwide enhanced oil recovery industry relying on the use of anthropogenic CO₂ as the primary stimulus for a dramatic increase in the amount of oil recovered from already discovered oil fields across the globe. Industry is poised for this challenge. The scientific and engineering community is ready for the task at hand and governments are rapidly generating new enabling incentives and strategies for the transformation to take place. CERI, CSM and other Colorado partners are getting on board to make it happen.

Basketball Teams Qualify for RMAC Postseason Tournament

By Greg Murphy
Sports Information Officer

For the first time in School history, both the Colorado School of Mines men's and women's basketball teams qualified for the postseason Rocky Mountain Athletic Conference (RMAC) tournament in the same season. Despite losses in the opening rounds from both teams, there were several reasons for both teams to be proud of their performances this season.

The women's squad, led by second-year Head Coach Paula Krueger, recorded the best season in School history as she led the team to a School-record 19 wins against nine losses. In addition, the team posted the third best record in the RMAC (13-6) and the 13 wins were the most conference wins in School history. And this was despite a staggering amount of injuries to her squad that forced all four seniors on the team to average more than 30 minutes per game.

After starting the season 1-2, the Orediggers ran off a School-record nine straight wins, including an overtime triumph over nationally ranked Minnesota Duluth in December.

With a 14-7 record on Feb. 5 following a loss to Nebraska-Kearney, the Orediggers went 5-1 over their last six games, including

wins over regionally ranked foes Metro State and Regis on the road, to earn the No. 5 seed in the RMAC/Wells Fargo Shootout.

The Orediggers traveled to fourth-seeded Fort Hays State in the first round and trailed by four points at halftime (31-27) and tied the game at 37-37 with 15 minutes to play. However, the Tigers went on a big run and ended CSM's season.

Junior center Ashley Gronewoller was a First Team All-RMAC East Division selection, while senior forward Kristin Horkey and senior guard Kim Kilmer were both Honorable Mention All-East Division picks.

The men's team, guided by fourth-year Head Coach Pryor Orser, stood at 11-4 overall heading into the rugged RMAC East Division part of their schedule. Two of the losses were to NCAA Division II Tournament qualifiers Nebraska-Omaha and South Dakota. In the overtime loss to South Dakota, senior guard Stephen Bahl scored a career-high 50 points, including 45 after the first half.

The Orediggers opened the East Division portion of its schedule with a win over Regis and the following night, the squad posted a 74-71 upset of then No. 1-ranked Metro State in Volk Gymnasium behind 24 points, eight rebounds and seven assists.

Injuries and illness hampered the Orediggers down the stretch as they finished with a 16-11 record (10-9 RMAC) to earn the seventh seed in the RMAC/Wells Fargo Shootout. That meant Mines had to travel to second-seeded and nationally ranked Fort Lewis in the first round.

CSM fell behind 37-12 at halftime and could not rebound as the Skyhawks ended their season.

Bahl wound up his career by being named to the All-RMAC First Team, All-RMAC East Division First Team and was the DAKTRONICS North Central Region Player of the Year and a First Team All-Region selection. He is eligible for All-American honors, but the selections were not available at the time of printing.

He also became just the third player in CSM men's basketball history to notch 2,000 career points in a Feb. 12 win over Chadron State in Volk Gym. He finished his career third on the all-time scoring list at Mines with 2,067 points.

Junior guard Kevin Wagstaff was a Second Team All-RMAC East Division pick, while senior forward Farris Broussard was an Honorable Mention All-RMAC East Division honoree.

Kristin Horkey was an Honorable Mention All-RMAC selection.

Two Wrestlers Earn All-American Accolades

Five wrestlers competed at the 2005 NCAA Division II Wrestling National Championships on March 11-12 and two grapplers earned All-American honors for their performances. The two All-American performances helped Mines finish 19th overall as a team with 17 points.

Senior 165-pounder Peter Jenson led the way as he earned All-American status for the first time in his career with a fifth-place showing. He went 4-2 with one fall during the championships.

In addition, junior heavyweight Derek Thompson picked up All-American honors for the second straight year by placing eighth in his weight class with a record of 2-3 with one fall on the weekend.

Jenson and Thompson were the fifth and sixth All-Americans coached by third-year Head Coach Steve Kimpel.

Freshman 184-pounder Dillon Blackmon just missed qualifying for the All-American rounds as he went 1-2 at the tournament. A win in his final elimination match would have guaranteed him All-American status.

Sophomore 133-pounder Garrett Eller and senior 197-pounder D.C. Hazen each qualified for nationals and both went 0-2 at the championships.



Senior Peter Jenson earned All-American honors after placing fifth in the nation at the NCAA II National Wrestling Championships at 165 pounds.

Track Athletes Earn Six All-American Honors

The men's and women's indoor track and field teams were in action at the 2005 NCAA Division II Indoor Track and Field National Championships March 11-12 in Boston. The men's squad placed 25th overall, while the women's team was 23rd.

On the women's side, junior Heather Beresford finished second in the mile run with a time of 4:50.60, less than one second behind the champion.

In addition, the women's distance medley team placed 10th in a time of 12:13.39, two spots out of All-American status.

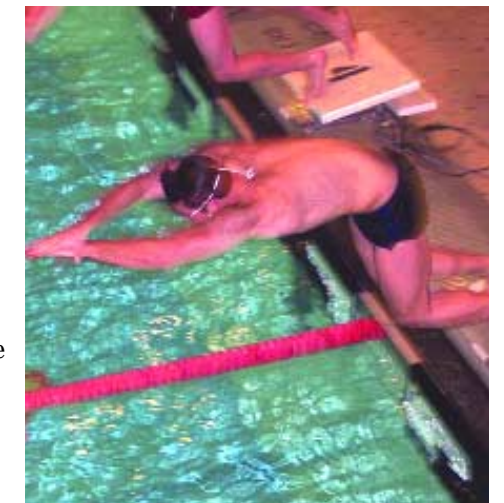
For the men, senior Jared Peacock finished sixth in the 800-meter run in 1:53.00 to earn All-American accolades. Peacock also helped the distance medley team to All-American honors with a sixth place showing in 10:00.69. Other team members included sophomores Larry McDaris and Joel Hamilton and junior Ross Wagle.

Kummer Shines at Swimming National Championships

CSM junior Travis Kummer earned four All-American honors at the 2005 NCAA Division II National Swimming and Diving Championships March 9-12 at the YMCA Aquatic Center in Orlando, Fla. Kummer's four All-American swims helped Mines to a 20th place team finish.

Kummer began his run by placing seventh in the 200 individual medley at Wednesday's finals in 1:53.47. Thursday, Kummer placed 15th in the 100 butterfly (50.63) and posted a sixth-place showing in the 100 breaststroke in the finals (56.97) on Friday. Kummer rounded out his run Saturday night with a seventh-place showing in the 200 breaststroke with a time of 2:04.47.

Head Coach Dave Hughes has now coached 22 All-American performances during his four years at the helm.



Stephen Bahl was named the North Central Region Player of the Year.

Evans Recalls 60 Years of Service to Mines

By David Rein

Hugh Evans EM '49 traces his interest in mining to his days as a young boy when the Evans family would vacation in Grass Valley, Calif., on the North Star Mining

fortunate to have had the guidance of Hugh Evans for the better part of the last decade. His knowledge of the School and the resources industries, and his commitment to the possibilities the future holds for Mines have been tremendous assets to our campus and its students."

Ironically, Evans' long-term relationship with Mines almost never happened. He first planned to attend MIT or Cal Tech, but then, as he relates, "Uncle Sam invited me to join the armed forces in World War II." Evans' college aspirations were put on hold while he served in the 10th Mountain Division, the only division-strength American military unit trained specifically for mountain and cold weather warfare. This unit suffered heavy losses during its 114 days of combat, but was responsible for crippling or destroying nine enemy divisions. Evans' combat record shows he earned the Silver Star, a Purple Heart and the Combat Infantryman's Badge.

This military service brought Evans to Colorado and into contact with CSM. The 10th Mountain Division trained at Camp Hale, Colo. While stationed there, Evans became convinced that Mines was the place for him. "I learned that this school was much more practical from a mining standpoint than MIT or Cal Tech. I was more of a down-to-earth type engineer as opposed to an esoteric scientist. And I was not disappointed. I got an excellent education that enabled me to pursue a career in mining."

He fondly recalls that one of the practical lessons he drew from his "excellent" Mines education was that the tools of the trade could be used for "multiple purposes." During Evans' sophomore year he worked as a night security officer at the local

reformatory for boys. He would be locked in at 7 at night and let out at 7 a.m., "which was very conducive to studying." During his tenure at the reformatory, "I learned that my rock-testing kit could also be used to saw the locks off of doors." Hugh had loaned his kit for rock identification to the kids to play with. They managed to file their way through the reformatory's padlocks. Evans and his co-workers spent hours driving across the fields of Golden in Buttercup, a used 1937 Chevy sedan that he had knocked the top off of, searching for his runaway charges.

On a more serious note, Hugh also remembers some of the more important matters he learned at the School as a student, varsity wrestler and founding leader of the Glee Club. He gained valuable lessons in getting along with his peers under difficult circumstances, particularly in the "unique exercise" that was mine surveying.

Evans leaves the Board with a dream for Mines' future. He states, "The School has all the various elements in place to be the center for mining and sustainable development worldwide. We have excellent departments dealing with the social, economic, cultural, business and political aspects of this industry. We have very good departments dealing with environmental issues – chemical and water pollution and other issues associated with the industry. The School is taking a lead in research into renewable energy. And we promote a hands-on, practical approach to basic industries."

These interrelated programs, Evans argues, enable Mines to turn out graduates that have the tools and understanding to make sound decisions, the kind of decisions needed for miners to work for the mutual benefit of industry and the communities in which mining interests operate.

Evans provides an analogy. Years ago he worked on a Navajo reservation where the prevailing custom when a man died was to knock a hole in the south wall of his hogan, remove the body through the opening and then abandon the dwelling, leaving it as a place for the man's soul to

reside. Since hogans were traditionally made of log and mud, the Navajo did not consider them permanent living structures. At the time, a well-intentioned home construction program for the

Hugh and his wife of 55 years, Ann, have been extraordinarily generous to Mines over the years. They have been members of the Mines Century Society at the Silver level since the Society's inception in 1996, and because of their leadership support for the *Transforming Resources* campaign, they will be recognized at the Gold level this fall. Yet, Evans modestly shrugs off compliments regarding his support of the School. "My 'gifts' to the school are actually investments. I contribute to the school through a charitable remainder trust. This is a sound investment. My wife and I get income from these gifts. The remainder then goes to the School when we pass on. It's a win-win situation, supporting the School and at the same time providing security for myself and my wife in our elderly years. I have found out that this is a very useful tool for me and for the school and I would strongly encourage others to look into it."

Despite his history of service to both his country and his alma mater, Evans objects to special commendation. He says, "I know our generation has been tagged as the Greatest Generation. That's probably suspect. We're pretty much the same as other generations. Looking back, we seem to have reacted reasonably well to extreme circumstances."

"I'm pretty optimistic about the young people I see and what they're doing and what they're trying to do. They have very different problems. So many things are being dumped on them. I think they have tremendous challenges from overload. But, I see young people struggling with these issues and trying to give back to society."

Navajo was enacted by the U.S. government. The program, which sought to establish durable, long-term housing, ran counter to cultural norms and consequently met with limited success.

Relating this experience to mining, Evans argues, "That's where Mines is so important. Our students understand that efforts to develop a mining property have to be worked out in cooperation with industries and the people who are where the ore is."

Evans also sees that major challenges confront Mines in the years ahead. Colorado, he posits, is the least supportive financially of higher education of any of the 50 states. TABOR and Amendment 23 are combining to drastically diminish state revenues for higher education.

"Dr. Trefny and the Board," Evans says, "have done all they can to reduce costs and be more efficient and fortunately we do have, have had, and will continue to have strong support from alumni and others. But we're at the point now where we are no longer cutting fat but cutting bone."



"Buttercup," a 1937 Chevy, was Evans' sidekick during his years at Mines.

Mines Acknowledges Individual, Corporate and Foundation Donations

Colorado School of Mines received gifts of \$25,000 or more from the following individuals between January 1, 2005 and March 31, 2005.

Fred Dueser '49 completed his *Transforming Resources* campaign pledge with a gift of \$200,000 to name an endowed scholarship in support of nonresident students. Adding to a previous pledge payment of \$50,000, this recent generous gift brings Dueser's total scholarship support to \$250,000.

Patrick J. Early '55 became a member of the Simon Guggenheim Society with an unrestricted gift of \$25,000 in honor of his 50th reunion.

Mines received a bequest of \$46,454 from the estate of friend of the School, **William H. Feldmiller**. The bequest will support the Feldmiller Public Service Scholarship.

With a gift of \$500,000, **Jim '59 and Arlene Payne** completed their \$1,000,000 *Transforming Resources* pledge in support of the James L. and Arlene H. Payne Endowment. This endowment funds The John C. Hollister Graduate Fellowship in Geophysics, The George Meredith Scholarship in Geophysics and The Paul Keating Graduate Fellowship in Geology.

Edwin W. Peiker, Jr. '54 renewed his membership in the Simon Guggenheim Society with an unrestricted gift of \$25,000.

Colorado School of Mines received gifts of \$25,000 or more from the following corporations and foundations between January 1, 2005 and March 31, 2005.

The **Viola Vestal Coulter Foundation** gave gifts totaling \$108,000 to support the Coulter Chair in Mineral Economics, the William Jesse Coulter Instructorship in Mineral Economics, the Viola Vestal Coulter Instructorship in Mineral Economics, the Mineral Economics Department for Professional Development Fund, the Mabel M. Coulter Student Health Center, Viola Vestal Coulter Foundation Graduate Fellowships, Viola Vestal Coulter Foundation Undergraduate Scholarships and William J. Coulter Outstanding Undergraduate/Graduate Stipends.

ICI Group contributed \$83,568 to support Professor Kim Williams' research in the Department of Chemistry and Geochemistry.

Phelps Dodge Corporation gave a gift of \$113,041 to support a graduate student in the Department of Geology and Geological Engineering.

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



Hugh and Ann Evans

property. Those summer months stimulated a lifelong fascination with mining, and an interest in devoting his career to the field.

This interest ultimately developed into a 60-year relationship with Colorado School of Mines. Evans was a student in the 1940s, then a benefactor, Board of Trustees member, Alumni Association board member and recipient of Mines' Distinguished Achievement Medal (1979). He came full circle as a student when he briefly held the position as Mines' oldest doctoral candidate.

Evans' eight years of Board service concluded April 1. As President John U. Trefny stated, "Mines has been extremely

The Best Little Truck Stop in Afghanistan

Expeditionary engineering at its best

By Maj. Joseph E Staton BSc CPR '89 and Lt. Col. Michael P. Crall, PE



One cold day in March 2004, the secure phone rang in the Fort Bragg, N.C., headquarters of the 27th Engineer Battalion (Combat) (Airborne). The voice on the other end outlined a mission: rapidly deploy by air with a tailored battalion engineer mission force to construct a forward operating site in a remote area of Afghanistan near the Pakistan border. "Can you do it?" asked the joint task force liaison officer. The site capabilities were to include an airfield with the ability to put five C17s on the ground simultaneously, accommodate 14 rotary wing aircraft including a matted taxiway, an 80,000-gallon refueling point, and a 500-man base camp. "By the way," the liaison officer injected, "this is a non-permissive environment; the road network is virtually non-existent, you must have a short take-off and landing capable airstrip in 72 hours, and your mission force must secure itself."

"The only way to get the engineer equipment in there is by parachute."

"As our motto says, 'We do all things well,'" replied the command group. "When do we leave?" So began the short-fuse planning to establish Forward Operating Site (FOS) Carlson in southeastern Afghanistan in an austere, high-altitude region. This was expeditionary engineering at its best.

The largest heavy drop of engineer equipment since World War II occurred April 25, 2004, from five C17 aircraft. Because of good planning by all involved, all platforms landed safely. Following the drop, de-rig teams swarmed to the infrared-marked platforms and expertly removed parachutes, lashings and rigging. Forty-two hours after the last platform was de-rigged, an Air Force plane

"Sounds like a challenge," retorted the command group. "Why the Tiger Battalion?" The liaison officer answered, "The only way to get the engineer equipment

landed on a newly constructed assault landing zone, a credit to the detailed planning, preparation and execution of the initial entry force. FOS Carlson was beginning to take shape.

The decisive operation was the expansion of the runway to C130/C17 capability. The technicians and surveyors stayed 24 to 48 hours ahead of the construction crews to finalize site layout of the landing zone, taxiways and base camp. As the landing zone was being expanded, the light equipment platoons encountered numerous obstacles that had not been apparent in the initial reconnaissance reports. No water was available within 10 kilometers and the extremely large rocks in the silt/sand material made soil strength readings difficult. Although the airstrip was constructed without water, achieving the required C130 and C17 soil strength and surface functionality would require more than 35,000 gallons of water per day. Reconnaissance of an area three kilometers south of FOS Carlson yielded a potential water source in a wadi under a lime rock outcropping. After digging down six feet, water pooled allowing a water distributor to upload and deliver water to the construction site. The cycle time was one hour per 2,500 gallons, requiring the distributor to run continuously. A mounted security force protected the route and upload site for the first 30 construction days.

Because of the large rocks that were two to six feet below the surface, dynamic cone penetrometer (DCP) readings used to determine the soil-bearing capacity became a concern. *The Engineer Technical Letter*, published jointly by the Army and Air Force, defines construction standards that include dimensional and soil-strength requirements. High, potentially inaccurate DCP readings were a concern because it was believed that the strength of the soil between the large rocks might not support C130

loading. Although the engineering mission force was experienced and deemed the runway ready for use, they decided to consult with others to make sure. Luckily, the battalion had brought along a portable video teleconference kit. The kit gives battlefield engineers the ability to seek engineering expertise in the United States through teleconferencing. The engineers in Afghanistan teleconferenced with engineers in Mississippi and Florida. Based on the analyzed data, it was determined that the runway was suitable for both C130 and C17 landings. The construction effort continued culminating with the assault landing of a C130 after three weeks on the ground. Where nothing stood before, there was now an operational C130 assault landing zone.

For over two weeks, soldiers were rationed six bottles of water and one meal-ready-to-eat per day.

force coordinated for daily re-supply of critical water, fuel and food using air assets. For over two weeks, soldiers were rationed six bottles of water and one meal-ready-to-eat per day. Shaving and bathing were not an option. The battalion required daily re-supply from a combination of C130 parachute deliveries, CH-47 helicopters and air-land aircraft.

Finally, locally contracted truck loads of essential supplies started arriving and continued through the remainder of the build-up. The Vertical Construction Platoon, initially acting as the

Critical sustainment supplies were supposed to arrive on locally contracted trucks starting by Day 3. Unfortunately, the first trucks did not arrive until Day 14. The engineering mission

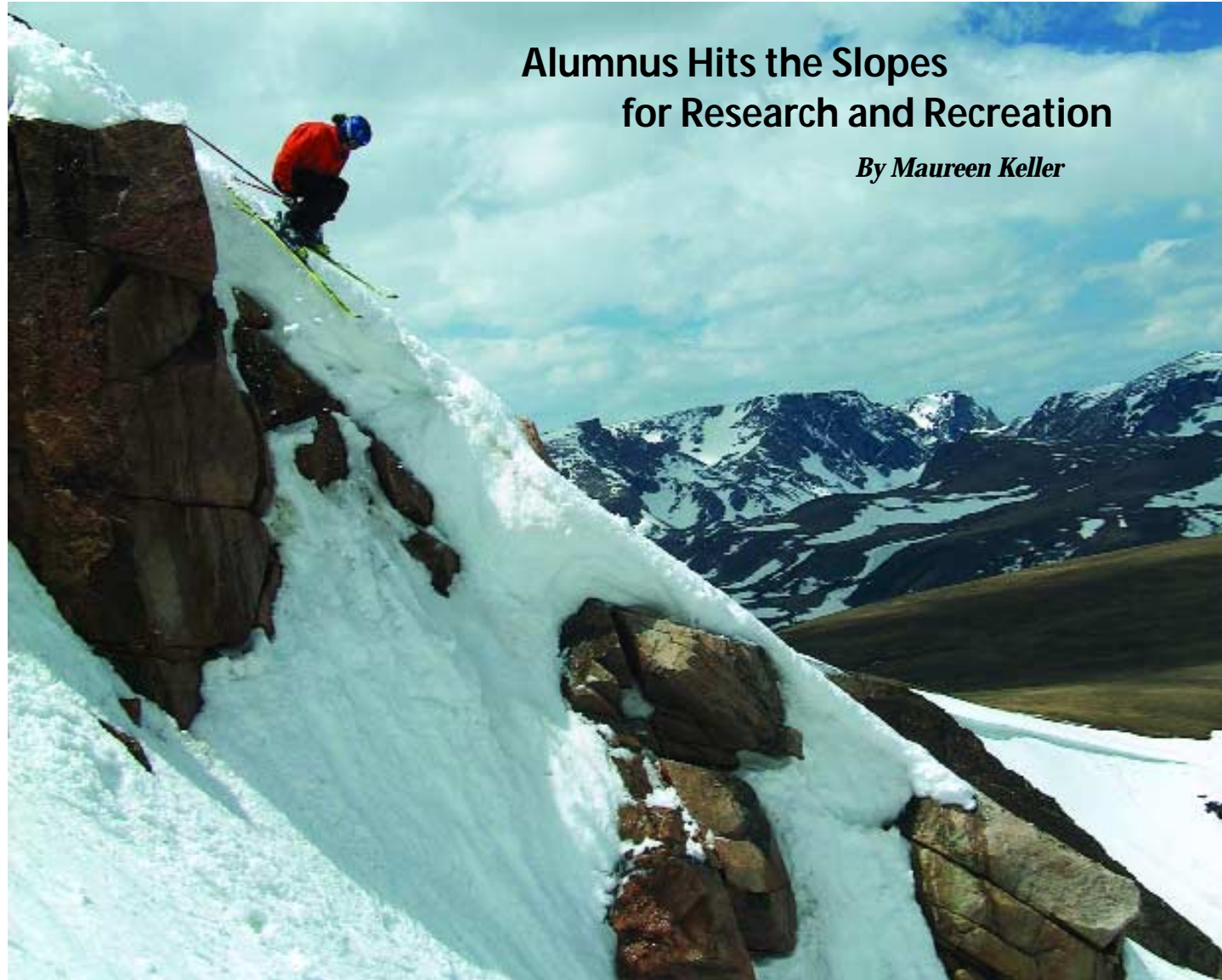
headquarters security force, began construction of the base camp. With the completion of 8-foot force protection berms, initial guard towers and bunkers, the battalion moved from foxholes to environmentally controlled Alaskan tents by Day 24 – a major improvement to force protection and quality of life, especially since the daily temperature reached 120 degrees F.

By Day 30, the Joint Task Force could project combat power from an expeditionary site across southeastern Afghanistan. FOS Carlson was now capable of landing C130 aircraft, parking 10 rotary wing aircraft on a matted taxiway, fueling rotary wing aircraft from a 40,000-gallon refueling point and was growing to sustain an additional 300 personnel with quality-of-life enhancements.

After 120 days, FOS Carlson was built to the master plan standard and a C17 successfully landed. FOS Carlson consisted of a 7,300-foot runway, 5,200-foot taxiway, parking for five C17/C130 and 14 helicopters and an 80,000-gallon refueling point. The base camp could house up to 500 soldiers in climate-controlled tents and provide food, showers, laundry and morale support. The only support center in the region, FOS Carlson gained the reputation as "the best little truck stop in Afghanistan."

We had successfully shaped terrain to enhance the maneuver of the Joint Task Force. FOS Carlson enabled combat operations in this remote region of Afghanistan at a time and place of the Joint Task Force's choosing. The success of this operation can be credited to the warrior ethos of the airborne engineer soldiers, the versatile organizational structure of a corps' airborne engineer battalion, and our aggressive engagement in the area of operation. The future expeditionary engineer force? It's here, it's now and it works.





Alumnus Hits the Slopes for Research and Recreation

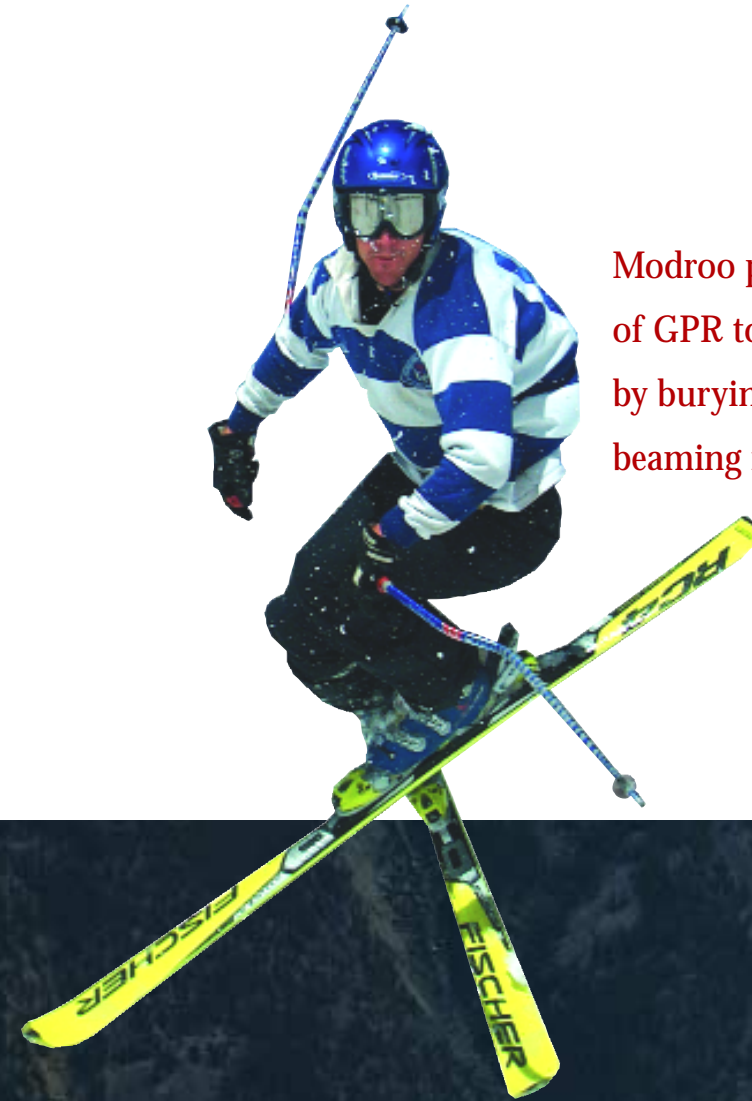
By Maureen Keller

Justin Modroo BSc Geop '01, MSc Geop '04 combined his love of skiing with academics when he earned a master's degree at Mines last year, proving once again that athletics and intelligence go well together. In 2004, Modroo was ranked 6th in the world in big mountain free (more commonly known as "extreme") skiing. He has skied competitively since he was in elementary school and now that his studies are completed, he's back on the circuit.

But before graduation last December, Modroo's focus was on ground penetrating radar (GPR) and its possible use for finding avalanche victims. GPR is commonly used to image the Earth's subsurface to find electrical wires or to detect water tables. Modroo's research proved it can also be used to detect bodies beneath snow. "Snow and ice make a great medium for using

GPR," says Modroo, "The contrast between electrical conductivity in snow and for humans is great." Modroo proved the ability of GPR to locate bodies by burying a dead pig and beaming radar at it. He discovered that a single GPR antenna wired to a laptop could distinguish the pig from snow, backpacks, logs, even dirt clogs. The sooner an avalanche victim can be located, of course, the more likely the victim is to be found alive.

Currently, avalanche victims are searched for using rescue dogs and 8-foot probes. Some back-country skiers wear personal beacons that emit a signal that can be pinpointed in case of an avalanche; however, use of the beacons is not widespread. No beacons were detected by rescuers in Utah in the massive avalanches that occurred in January. Searching for victims with



Modroo proved the ability of GPR to locate bodies by burying a dead pig and beaming radar at it.

dogs and probes is a slow, tedious, often dangerous process.

Modroo's research proved that GPR can find humans buried beneath snow, but the technology is still a long way from being implemented for avalanche search and rescue operations. GPR units cost about \$30,000 each and are designed for exploration. What is needed for search and rescue is a system that could fit on the skids of a rescue helicopter that would fly over avalanche sites. Designing a prototype could cost as much as \$1 million, says Modroo. He has presented his research at two international conferences, but has no takers so far.

"If my research continues, we could develop software to interpret data that could make GPR more user-friendly," Modroo says. "It's a technology I know will get implemented eventually, but it's expensive and there's not much motivation to do it right now. But I see it evolving."



Rx for Success

By Maureen Keller

Mines alumni in the medical profession – doctors, veterinarians, nurses, physical therapists, emergency medical technicians and dentists – agree: Their prescription for success includes the excellent education they received at Mines.

“An engineering degree is a good basis for medical training because it teaches you how to think, how to problem solve and how to look at a problem from multiple angles,” says **Erika Nelson-Wong BSc Phy '92**, a physical therapist. Engineering is the application of basic sciences, adds **David Liu BSc Met & Mat Eng '03**, a medical student. “For me, it was studying the structure and properties of materials. The same basic principle pertains to medicine; it is the application of basic sciences toward the treatment of human disease.”

Family physician **Alfred Po-Hung Wu Geop E '72** compares electrophysiology, the study of the electrical properties of the heart, with mapping the surface of the Earth while searching for oil. The mathematical approach is the same: mapping downward (or inward) based on surface data.

A Mines education provides more science and mathematical knowledge than a typical pre-med course, according to alumni. Wu says his degree made him stand out from his peers when applying for medical school. A member of the medical school admissions committee later told Wu it was his recommendation from a *mathematics* professor that made him memorable.

“Engineering principles can be applied in all facets of life and medicine is just one example,” says **Thomas Milner BSc Phy '81, MSc Phy '86**, who is a professor in the biomedical engineering department at



Thomas Milner

University of Texas at Austin. “Engineering forces you to think analytically and learn problem-solving approaches that can be applied to a broad range of disciplines.” **Timothy Judkins BSc Chem Eng '01**, a medical student, says engineering graduates also “provide diversity to medicine, which is dominated by people with biology backgrounds.”



Timothy Judkins

Engineering and medicine have more in common than one might think. “Both are very methodical and deal with problem-solving,” notes **David Graham BSc CPR '99, MSc Chem '02**, a student at Albany Medical College. “Each has diagnoses and methods of treatment. Both require a great deal of thought and experience to succeed.” A doctor needs to be able to think about a problem and create solutions.

Harry Temple Jr. PE '69, a dentist who spent two years as a petroleum engineer before changing careers, also sees similarities in the two careers. “I’m a dentist so I’m still drilling, just on a smaller scale.” Temple is a prosthodontist, which, he says, “uses a bit of engineering, strength of materials and a whole lot of common sense.”

The study of the human body also can be compared to the study of chemical engineering. The heart is the pump, the vasculature system the pipes, the scrubbers/filters are the kidney/lungs and the CPU

Rx for Success

[central processing unit] is the brain. “Each has intrinsic factors similar to their engineering counterparts, such as resistance, pressure and flow properties,” David Graham says. “Both employ great technologies that must be understood and applied. A foundation is needed in order to fully appreciate the complexities of man and the tools used to heal him/her. The body is an engineering masterpiece; as such, medicine is the application of engineering principles in order to provide symptomatic relief in some form.”

Daniel Johnson BSc Geop '85, an internist with subspecialty in hospice and palliative medicine, advises students contemplating medical careers to “broaden the way in which you approach medicine – far beyond a scientific endeavor. Learn as much as you can about people, their passions, culture and diversity.”



Daniel Johnson

Geology is also like medicine, notes **Mikyong “Mikki” Hand BSc Pet '91, MSc Engr Sys '97**, a family physician, “in that it comprises memorizing lots of structures and then putting them together into a system and trying to make inferences about how/why a system is the way it is.” She compares the natural log decline that describes drug clearance from the body as being the same concept that describes the basic decline in production from oil reservoirs.

“I think the heart of any good education is teaching a student to be an adult learner and Mines does that very well,” says **John Blackwell BSc Eng '91**, a doctor who specializes in interventional radiology. “Recognizing what you do not know, subsequently learning that information and applying the knowledge responsibly are the keys to succeeding in both engineering and medicine.”

Peter Stout MSc Env Sci '94, a forensic toxicologist, says the pharmaceuticals field includes a lot of chemical engineering in both production and molecular modeling. But he says that “not enough young doctors have a clue about chemistry. And most toxicologists don’t have a good grounding in differential equations or statistics.” At Mines, Stout was required to take more math than he would otherwise have chosen. “But I don’t think you can ever have too good a grounding in math and chemistry.” Paramedic **Andy Jensen BSc Eng '98** agrees that what he learned in math classes at Mines makes the medical calculations required for his job easy for him.

“One of the most significant ways Mines prepared me was through the numerous hands-on lab courses,” says

Toni Bowden BSc CPR '95, a dentist in the U.S. Navy. “It was there that I was able to actually ‘see’ and experiment with things like titration rates, effects of different mechanical forces and especially Auto-Cad.”

“Engineering is such a versatile field,” says Bowden. “Learning dynamics, statics and physics are just a few of the basics of how the human body functions.” Bowden sees a lot of similarity between engineering and dentistry. “For instance, when determining the type of dental restorative to use in a tooth, I have to consider the mechanical, electrical and thermal properties of the material and how it may be affected by the person’s chewing habits (or biting forces) and saliva,” she says. “Also, from a physiological standpoint, the human jaw works

like a hinge – a class III lever system – so understanding the fulcrum and load is always important when trying to diagnose patient discomfort.”

Few of the Mines alumni now in the medical fields expected to follow the path they eventually took. **Michael Taravella BSc Chem '77**, an eye surgeon, planned to become an engineer, but changed to medicine because he wanted more contact with people. Erika Nelson-Wong chose physical therapy also for the people contact. **Gregory Meyer PRE '58**, a psychiatrist, was an aeronautical engineer for eight years before deciding he needed a new challenge. Mikki Hand went to medical school after discovering a shortage of women physicians in Alaska, where she was a petroleum engineer.

“Engineering is good for pretty much any career simply because you learn to problem solve whatever the problem may be,” says **Daniel Matlock BSc CPR '99**, a doctor of internal medicine.

“Both professions [engineering and medicine] exist to improve the human condition, adds Blackwell, “either improving our quality of life as a consumer of the engineered product or as a patient seeking a cure for their disease.”



Mikki Hand

“I have nothing but great things to say about Mines and my education there,” says Mikki Hand. “Engineering school was much more difficult and challenging than medical

school.” **Scott Pauls BSc CPR '81**, an emergency room doctor agrees. “Academically, engineering was more difficult than medical school.”



Toni Bowden

Events calendar



May	June	July	August
<p>20 CSM Athletics Fundraising Dinner and Auction. 5 p.m. For more information or reservations, call 303-384-2254.</p> <p>26 Abilene, Texas. NCAA II Outdoor Track & Field Championships. TBA.</p>	<p>Grand Junction, Colo., section luncheon: second Thursdays. Bookcliff Country Club, 2730 G Road, noon. For information call John Howe at 970-242-4903.</p> <p>22 Meet with Tom Spicer, Bob Stitt, Pryor Orser, Paula Krueger, Steve Kimpel and others. 6:30 p.m., Friedhoff Hall, Green Center. \$10. Hors d'oeuvres and beverages.</p>	<p>Downtown Denver Mixer. See June 9 for details.</p> <p>Grand Junction, Colo., section luncheon See June 9 for details.</p> <p>27 Mines night at Rockies vs. Mets baseball. 7:05 p.m. Call 303-273-3295 for tickets. \$18 per person.</p> <p>TBA Denver-area Fishing Derby/Ride to Royal Gorge Train/Rafting on the Arkansas outing. If interested in any of these activities, contact Bob Pearson, 303-273-3959.</p>	<p>11 Golden, Colo., Lunch Bunch. See June 9 for details.</p> <p>Grand Junction, Colo., section luncheon. See June 9 for details.</p>
<p>June</p> <p>02 Mines Metro Mixer, rotating locations TBA. Check website for details. 5-7:30 p.m. Pay own way.</p> <p>06 Annual Golden Alumni Golf Tournament. Fossil Trace Golf Course. 7:30 a.m. shotgun start.</p> <p>09 Golden, Colo., Lunch Bunch: second Thursdays at Buffalo Rose, 1119 Washington, 11:30 a.m.</p>	<p>July</p> <p>07 Mines Metro Mixer. See June 2 for details.</p> <p>14 Golden, Colo., Lunch Bunch. See June 9 for details.</p>	<p>August</p> <p>04 Mines Metro Mixer. See June 2 for details.</p>	<p>September</p> <p>01 Mines Metro Mixer. See June 2 for details.</p> <p>08 Golden, Colo., Lunch Bunch. See June 9 for details.</p> <p>Grand Junction, Colo., section luncheon. See June 9 for details.</p>

For the most up-to-date information on what's happening in your area, check the website at www.alumnifriends.mines.edu and click on "News and Events" (top of page). Scroll down to the calendar.

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For more information, contact the Managing Director, CSM Foundation Inc. Linda M. Landrum at (303) 273-3142

CSMAA Honors Six

Donald E. Miller Met E '53 is this year's recipient of the Melville F. Coolbaugh Award, which is given to a person who has made an outstanding contribution toward improving the image and enhancing the reputation of CSM. Miller retired as vice chairman of The Gates Corporation after 35 years with the company. His involvement with Mines has been continuous and includes service on the Board of Trustees from 1987 to 1997, three of those years as president. He also has served on the CSM Foundation Board of Directors since 1988 and was president from 1994 through 1998. In addition, he and his wife, Barbara, have provided scholarship endowments. In 1985, he received CSM's Distinguished Achievement Medal.



The Outstanding Alumnus Award was given to **Robert "Bob" Pearson PE '59**. Pearson was a coach at Mines throughout his career until he retired in 1998. The highlight, he says, was as soccer coach. In his last five years, his team won four conference championships. Even today, Pearson never misses an opportunity to promote athletics at the School. Pearson has served on the Alumni Association Board of Directors and the CSM Credit Union Board of Directors and currently is sections manager for the Association, organizing and attending section events throughout the country. Pearson is a member of the Athletics Hall of Fame, a Mines Medalist and an honorary member of the Association.



Karen (Manski) Maestas BSc Geol '91 is this year's Young Alumnae Award winner. She is a project manager, team leader, and quality assurance manager for URS Corporation's environmental division in Denver. She was one of URS' first certified project managers and manages projects in the United States and Japan for commercial and U.S. Air Force clients. For many years, Maestas also served as a campus recruiter for Radian International/URS at CSM. She was so successful at placing Mines graduates at the company that the two environmental engineering teams now consist of nearly 50 percent Mines graduates including both team leaders. Maestas is a member of the Colorado Hazardous Waste Management Society and the Society of Military Engineers. She served as newsletter editor for the Metro Denver Association for Women Geoscientists for several years.



Honorary Memberships in the Alumni Association were awarded this year to **Jerry Marshall, Frank A. Hadsell DSc Geop '61** and **Robert "Bob" Stitt**. Additionally, the CSMAA Board of Directors voted in February to grant Honorary Memberships to Honorary Degree recipients when they are not already alumni. William J Barrett, Honorary Degree recipient for December 2004 (see *Mines* Winter 2005), and Charles Vest and George

Tchobanoglous, the May 2005 Honorary Degree recipients, have been given Honorary Memberships by the Association (see more in next issue of *Mines*).

Jerry Marshall attended Mines in the mid 1950s, although he did not graduate. He left school and began a career at CF&I Steel Company, rising through the ranks until he retired in 1999 as manager of sales. He sold drilling and mining supplies and thus kept in contact with Miners throughout the world. In the 1960s, Marshall was an associate member of the Alumni Association in the Midland, Texas, area and was heavily involved in promoting the School, including helping to recruit several athletes. Throughout the years, Marshall secured summer jobs for Mines students and helped place CSM graduates in the steel industry. Since retirement, Marshall has actively worked with the CSM Athletic Department to recruit student-athletes and enthusiastically supports CSM's athletic activities.

Frank Hadsell, CSM geophysics professor emeritus, launched hundreds, if not thousands, of young students into productive, fulfilling careers in Earth sciences and mineral engineering. Hadsell, raised on a Wyoming sheep ranch, ran into a Mines professor, Ralph Homer, while herding sheep one day and talked to him for an hour or so about geology and physics. He became more interested as time passed, leading to his eventual career as a geophysics professor. Hadsell has written two books on geophysics and, with another CSM professor, helped the School increase its involvement in seismic studies. Hadsell also helped found the faculty senate and faculty club. He is a long-time member of the Alumni Association and served on the history committee that resulted in publication of *Rocky Mountains to the World: A History of the Colorado School of Mines*.

Bob Stitt is CSM's head football coach, now in his sixth year. Last season, Stitt led the squad to the best season in School history as the team won its first Rocky Mountain Athletic Conference title since 1958. In addition, the team posted a perfect 11-0 mark in the regular season and advanced to the NCAA Division II Playoffs for the first time in program history. Stitt's winning percentage is the highest by a Mines football coach who has coached in at least 20 games and the highest for a modern-day coach at CSM. The record-setting season helped Stitt be honored as the RMAC Coach of the Year, as well as the Division II American Football Coaches Association Regional Coach of the Year in Region 5 and the d2football.com Southwest Regional Coach of the Year. Stitt also was instrumental in helping senior quarterback Chad Frieauf win the 19th Annual Harlon Hill Trophy as the top player in Division II, the first player from Mines and the RMAC to win the award.





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Metro Denver

A new CSMAA executive board took office in February. From left, **Roger Newell '71**, treasurer, **Kathy Altman '80**, president-elect, **Lori Stucky '97**, secretary, and **Alan Mencin '79**, president.



Southwest

Arizona

Three Miners and their wives vacationed in Venezuela in February. From left, Nancy Wieduwilt, Marian Kendrick, **Gordon Miner '48**, Marj Miner, **Gordon Wieduwilt '53** and **Bob Kendrick '54**. →



West

Las Vegas, Nev.

A group of alumni met in Las Vegas in March to watch the March Madness basketball games together. Clockwise from right, **Steve Harvey '63**, **Jae Edwards '66**, **Bob Pearson '59**, **Bill Wahl '58** and **Boyd Watkins '64**. →



Spokane, Wash.

Several Miners met for breakfast during the Northwest Mining Conference in Spokane. Attendees included **Henry Bates '41**, **Don Bennett '63**, **Mike Dreher '69**, **David Hebb '73**, **Steve Harvey '63**, **Mike Mastor '82**, **Trey White '91** and **Sasha Karpov '80**. →



Central Washington

Bob Pearson '59 had a meal with the Mines baseball team, which was competing in Ellensburg, Wash., in March. ↓



East

Boston, Mass.

Mines fared well at the Indoor National NCAA Division II Track and Field meet. **David Price '95** and **Jim Beideman '00** were on hand to cheer and take photographs. →



Philadelphia, Pa.

New section coordinator **Kiran Patankar '99** hosted his first section event in the Philadelphia area in February. In attendance were **Kevin Thompson '99**, **Tom Battle '83**, **Greg Kazel '87**, **Nancy Ballout '97**, **Jay Horvath '81**, **Bill Martin '89**, **Geoff Arbogast '89** and **Jaime Guzman '94, '96**. ↓ →



Gulf Coast

Bone Valley, Fla.

The Bone Valley group held its annual picnic in February this year. CSM President John Trefny and new alumni director, Anita Pariseau, also attended. The day included a field trip to a phosphate plant.



New Life Members

Virginia D. Carroll '98
Alex Chisholm '57
David D. Crichton '97
Meredyth M. Crichton '98
Jeremy K. Lee '01
Brady J. McConaty '78

Gina M. Morrison '85
J. Doug Neighbors '89
Pierson M. Ralph '48
Erik Ressel '96
Richard A. Ruggiero '78
Charles G. Weakly '86



ERLING "SWEDE" ARNSTON PRE '52 died peacefully at home Jan. 29 at age 79. Quick with a smile and comfortable with conversation, Arnston had the qualities of a man who enjoyed life. He enjoyed reading and sharing poetry or a good story, and was always the first to figure out an innovative way to "fix" something. His days were filled with gardening, carving wooden ducks, fly fishing, a good joke and the occasional outing in his '59 MGA. Before attending Mines, Arnston served as a combat infantryman in the Pacific during World War II. At Mines, he was a member of Sigma Phi Epsilon. In 1951, he married Bernie Kaltenbach. During their 54 years together, they raised two sons and a daughter. Both sons, Stace BSc Min '76 and David, also attended Mines. In 1987, Arnston retired from a career with Amoco Oil and moved to Grand Junction, Colo. It was there that he became active in the local Rotary club, participating in community activities and organizing its annual Christmas bell-ringing activities. Swede's love of life was recognized throughout his lifetime and he received many honors and distinctions including the Victory Medal, Asiatic Pacific Service Medal, Good Conduct Medal, the Loyal Alumnus Award from the Sigma Phi Epsilon fraternity, and the Paul Harris Fellow Award from his fellow Rotarians.

ALAN BAKEWELL EM '38 died Nov. 2 at home. He was 89. Bakewell was born in Illinois and met his future bride in grade school. Before graduating from Mines, Bakewell worked as a laborer for Caliente Cyaniding Company in Nevada. After graduation, he worked for Kennecott in Chile to earn enough money to marry Betty Bates. For their honeymoon, he took her to Nevada where



Mar. 11, 1941

he worked as a pit engineer for Standard Cyaniding. He then worked for Kennecott and he did both underground and open pit work. In 1954, the family moved to the Philippines where Bakewell was general manager for Baguio Gold. In 1959, the family moved to a nickel mine in Cuba for a year. Next was Cypress for the next 15 years. The Bakewells returned to the States in 1976 and moved to Reno, Nev., in the early '80s where Alan finished his career with Cyprus Amoco by opening the Northumberland heap leach facility. First and above all, Bakewell was a family man and "family" extended to friends from the mining camps around the world where he had lived. After retirement, Bakewell took on house ownership and gardening with his usual enthusiasm. His main recreation was golf and he played with some skill for almost 80 years. In all ways, Bakewell loved being active and moving things toward completion. His motto was "What can I do to help?" He is survived by his wife of 64 years, two sons and two granddaughters.

ARTHUR D. BERTANZETTI PHD MATH '94 of Littleton, Colo., died Oct. 27 at age 55. In addition to his Mines degree, he held a BE and master's degrees from Youngstown State University. Bertanzetti retired from Coors after 20 years of employment and at the time of his death, was employed by the U.S. Department of Homeland Security. He is survived by his wife of 32 years, Vickey, two sons, a granddaughter and a brother.

ANTON W. BOSCH EM '70 of Cheyenne, Wyo., died Dec. 31 at age 68. Bosch was a mining and environmental engineer and served in the U.S. Air Force. He was a member of American Legion Post 5 and the CSMAA. Born in The Netherlands, he became a U.S. citizen in 1963 while serving at F.E. Warren Air Force Base. Bosch was multilingual, speaking English, Dutch and German. In 1971, he married Lillian "Lee" Vincent. Bosch is survived by his widow, three sons, a daughter, a sister and two grandchildren.

MICHAEL R. "MICK" COLLINGS GEOL E '59 died June 12, two days shy of his 69th

birthday. Collings was born in Monroe, Utah, and moved with his family to Washington at the age of 7. He grew up on the Kitsap Peninsula and spent many afternoons delivering newspapers on his bicycle, often carrying little sister Nora on the handlebars. He was also close to his brother,



David, hunting and playing on the family's 11 acres near Bremerton. After graduating from Mines, Collings became a hydrologist for the U.S. Geological Survey, traveling throughout the country. His work involved detailed studies of area streams, water flow and the effect on area fish populations. He also served in the Army Reserves until his discharge in 1967. Collings met his future bride, Audrey June Ayer, in Colorado and they married in 1961. After retiring from the USGS, Collings pursued his dream of owning a ranch and raising cattle on a 140-acre ranch in Crawford, Colo. There, he and Audrey built their home and worked the ranch through long hot summers and bitter cold winters. Collings enjoyed the outdoors and was especially fond of spending his free time carving and woodworking. Survivors include his mother, sisters, two nephews, a niece, two grandnieces and a grandnephew. His wife, brother and father predeceased him.

WILLIAM J. "BILL" DOMORACKI MSC GEOP '86 died July 25 from cancer. He was 45. Domoracki was a research assistant professor at University of South Carolina Earth Sciences Resources Institute (ESRI-USC). In addition to his Mines degree, he held an undergraduate degree from State University of New York, Potsdam, and a PhD from Virginia Polytechnic Institute and State University. Domoracki joined ESRI-USC in 1995 with an extensive background in reflection seismology and applied geophysics. He was responsible for seismic



reflection data processing and operation of the institute's environmental geophysics laboratory. Prior to joining ESRI-USC, Domoracki was at the Regional Geophysics Laboratory at Virginia Tech where he researched the processing and interpretation of deep crustal and shallow high-resolution seismic reflection data. During his career he processed numerous P-wave, S-wave and VSP seismic surveys for crustal and environmental applications. He also acquired, processed and modeled numerous gravity and magnetic surveys. Domoracki was a member of the Geological Society of America, Society of Exploration Geophysicists, American Association of Petroleum Geologists and European Association of Geoscientists and Engineers.

LLOYD E. ELKINS SR. PET E '34 died Dec. 17 at the age of 92. Elkins, a native of Golden, Colo., was a member of Sigma Phi Epsilon, Tau Beta Pi, Sigma Gamma Epsilon and Scabbard and Blade while at Mines. He also played basketball. In 1948, he graduated from the Harvard School of Advanced Business Management and in 1963, received an honorary doctorate in science from University of the Ozarks. Elkins joined Stanolind Oil and Gas (now BP), where he remained for 43 years.



After retirement, he opened a private petroleum consulting office and subsequently was chosen as a member of the prestigious Arbitration Board selected to divide rights to massive oil properties in Prudhoe Bay, Alaska. Elkins was active in several professional societies and received many awards including CSM's Distinguished Achievement Medal. He was named to the Engineering Hall of Fame at Oklahoma State University and at University of Tulsa. He was a prolific writer of technical papers and was a recognized authority in secondary and tertiary recovery of oil. Elkins also served as president and board member of Family and Children's Services for many years and was one of the first Tulsa Library Hall of

Fame honorees. He was a founder of the Tulsa Petroleum Club and a member of Tulsa Country County and Kiwanis Club. An active churchman, he served in elder and trustee positions. He was also an avid supporter of CSM. Elkins is survived by his wife of 70 years, Virginia, a daughter, a son, six grandchildren and 12 great-grandchildren.

GEORGE R. GOEBEL MSC PHY '79 died Dec. 31 in Knoxville, Tenn. He was 58. Goebel spent more than 27 years in the nuclear industry. He provided consulting support to the Department of Energy in the development, upgrade, oversight and training of various programs. He was recently recognized for his performance as a technical consultant on the DOE's national Highly Enriched Uranium Vulnerability Study. He also served as project manager for criticality safety-related projects at several facilities including Paducah, Portsmouth and Lawrence Livermore National Laboratory. Goebel is survived by his widow, Carol, a son, a sister and his mother.



EDWIN F. GORCYCA PRE '50 died Dec. 15 in Texas. He was 82. Following graduation from Mines, Gorcycy worked at Monsanto Chemical Company for 30 years until retirement in 1987. He also served in the U.S. Army during World War II in the Philippines and Leyte Gulf. In 1947, Gorcycy married Sarah Lanz. In addition to his Mines degree, he also holds a bachelor of science in chemistry from Wooster College. Gorcycy was an active member of the First Presbyterian Church of Texas City, the Boy Scouts of America, Troop 219 and Toastmasters International. Gorcycy is survived by his widow, two sons, two daughters, a sister, nine grandchildren and two great-grandchildren.

GEORGE E. MOREHOUSE EM '49, MSC GEOL '50 died at his home in Grand

Junction, Colo., Nov. 7 at age 87. He had lived in Grand Junction since 1951. Morehouse was born in Tribune, Kan., and spent his youth in Idaho and Washington. He married Ruth Caton in 1942 in Seattle. Morehouse attended University of Washington and worked summers mining in Alaska to earn tuition. He joined the Army and served as a captain during World War II before graduating from Mines. Morehouse spent most of his life working in the mineral industry as an engineer, geologist and consultant in several western states. He was a member of the American Institute of Mining Engineers, the Geologic Society and Professional Engineers. He also spent 20 years ranching. George and Ruth spent their retirement years traveling to their favorite places in Alaska, Montana and along the Oregon coast. In between travels, Morehouse enjoyed volunteering at the Dinosaur Museum. His friends and family remember George for loving the outdoors, whether hunting, prospecting, riding horses, hiking or fly-fishing. Morehouse is survived by his wife of 62 years; a son, two daughters, two sisters, two grandsons and two great-granddaughters.

ROBERT H. MUENCH MET E '50 of Carefree, Ariz., died Sept. 13 at age 79. Muench was born in Colorado and served in the U.S. Army during World War II. Upon being honorably discharged, he attended Mines. After graduation he took a position with the Arabian-American Oil Company and moved his family to Saudi Arabia for the next 30 years. During this time, Muench and his family enjoyed travel abroad and he was able to experience some of the world's best golf courses. An avid golfer, Muench also loved to read, play



bridge and work crossword puzzles. He was a member of Kiwanis International and the Boulders Resort Country Club. Muench is survived by his widow, Betty, three daughters, a son, six grandchildren and three great-grandchildren.

LESTER BOSCO ROBERTS, a CSM student in the 1920s, died June 14 in Columbus, Ohio. He was 97. Roberts valued his two years at Mines, but necessity forced him to transfer to the University of Wyoming, where he graduated in 1928. After graduation, he became a petroleum engineer for the Ethyl Corporation. During his career, he represented his company in Argentina, England, South and Central Americas and the West Indies. He also served in the U.S. Army during World War II. While at Ethyl Labs, he worked on the team that statistically proved cigarette smoking caused lung cancer. He also researched the adverse effect on humans of tetraethyl additives in leaded gasoline, which led to the additives being removed from gasoline. After retirement, Roberts married Iola Sheppard and they moved to Dublin, Ohio, where he taught at Ohio State. His nephew, John C. Stoddard EM '52 says, "My uncle was a role model difficult to surpass. He delighted in my choosing CSM to matriculate and was pleased at my graduation. He always looked forward to my sharing copies of the *Mines* magazine."



ARTHUR H. SCUDAMORE PET E '37, a retired chemical engineer, died Nov. 10 at the age of 90 in Texas.

CHARLES MORTON STRAIN PET E '62 died Nov. 12 at age 64. Strain was born and raised in La Junta, Colo., where he was an Eagle Scout and member of the Koshare Indians. After graduation, he worked as a petroleum engineer in the Rocky Mountain region before earning an MBA from Harvard School of Business Administration. Strain then worked for Exxon subsidiaries for six years, primarily

in Venezuela, before moving to Houston in 1972. There he was an energy analyst for several regional brokerage firms. In 1991 he formed his own company to provide research and investment banking services for small public oil and gas companies. Strain was a certified financial adviser, a member of The Institute of Chartered Financial Analysts, the Society of Petroleum Engineers, Houston Energy Finance Group and Houston Producers Forum. He was also a member of Memorial Drive United Methodist Church. Strain was a loving husband, father and grandfather who always made family a priority. He is survived by his wife of 43 years, Ruth, two sons, a daughter and five grandchildren.

FRANK W. TODD EM '41 of Denver died Jan. 4 at age 87. Todd began his college career at University of California at



Berkeley where he was a member of Phi Delta Theta. He then moved to Colorado to attend Mines and was an outstanding track-and-field athlete. After graduation, Todd worked as a mining and mechanical engineer and was employed by Adolph Coors Company for 25 years. Todd is survived by six children, 16 grandchildren, 12 great-grandchildren and a brother. His wife of 60 years predeceased him.

ELLSWORTH B. WATSON MET E '31 of Santa Fe, N.M., died April 28, 2004, at age 96. A Denver native, Watson graduated from East High School before attending Mines. During his college years, he was a member of Sigma Phi Epsilon, ROTC and was editor of the *Prospector*. After graduation, he worked for the Jones and Laughlin Steel Mills in Aliquippa, Pa. During World War II, Watson served as first lieutenant in the 5th Army, stationed in the Aleutian Islands. After the war, he worked for Mountain Bell for 37 years, retiring in 1972. Watson was a



member of the Telephone Pioneers, was active in his church and the Braille Service of New Mexico. He was a 32nd degree Mason and a Shriner. Watson is survived by a son, a daughter and six grandchildren.

FREDERICK "FRITZ" WEIGAND PE '39 died peacefully at home Dec. 27 surrounded by his family. He was 92. Weigand grew up in Colorado and entered CSM at age 21. At CSM he played tuba in the band, became a second lieutenant in ROTC and was editor of the *Oredigger*. He met his future wife, Virginia Miller, because her father owned the paper that published the *Oredigger* and they married in 1939. After graduation, Weigand worked first as a laborer and then as an engineer. He was called into service in 1941. In 1942 he was hired by Stearns-



Roger and was an employee for 40 years. During that time he supervised the building of power plants in Montana, Kansas, Wyoming, North and South Dakota, Texas and Utah. He also traveled to Israel to consult on a nuclear power plant. Weigand retired as assistant manager of the power division in 1982. He was a lifelong supporter of CSM and a charter member of the Mines President's Council, among other things. He also belonged to several professional organizations and was a member of the Kiwanis Club of Golden for more than 60 years. He served on the Golden board of planning and adjustment, was a deacon and elder during his 60+ years as a member of the First Presbyterian Church of Golden, and was past-president of the Ione Duck Club and Naylor Lake Fishing Club. He was a Master Gardener and a charter member of Rolling Hills Country Club. In his leisure time, Fritz enjoyed gardening, hunting, fishing, rafting, traveling, building and repair projects, flying, attending cultural events and enjoying his family. His wife preceded him in death. He is survived by a daughter, Jane Diggs, two grandchildren, two great-grandchildren and many nieces and nephews.

Recreation Center Committee Sets Example for Peers

Bud Isaacs PE '64, Charlie McNeil EM '71 and 12 other former athletes and student leaders are doing all they can to ensure that the Mines campus will soon be graced with a state-of-the-art sports and fitness facility. These committed alumni, all of whom have gone on to become successful



Charlie McNeil

business and industry leaders, have joined forces to raise the resources needed to ensure that the School's Recreation Center becomes a reality. Recreation center committee members are all dedicated to improving the athletic program at Mines. They have donated countless volunteer hours, made contributions to specific team and program needs, and even established endowed athletic scholarships to support the academic pursuits of varsity team members. Most recently, McNeil and Isaacs have made financial commitments to the recreation center project: McNeil has pledged \$150,000 and Isaacs \$150,000 to help with construction. Mines will recognize their gifts by naming rooms in the recreation center in their honor. Any contribution to the center of more than \$50,000 will be similarly acknowledged.

Recreation center committee members are all dedicated to improving the athletic program at Mines. They have donated countless volunteer hours, made contributions to specific team and program needs, and even established endowed athletic scholarships to support the academic pursuits of varsity team members. Most recently, McNeil and Isaacs have made financial commitments to the recreation center project: McNeil has pledged \$150,000 and Isaacs \$150,000 to help with construction. Mines will recognize their gifts by naming rooms in the recreation center in their honor. Any contribution to the center of more than \$50,000 will be similarly acknowledged.

"As a former football player at Mines," Isaacs said, "I appreciate how important the opportunity to participate in sports and recreation is to a student's education. Athletic activities build confidence and mental and physical wellbeing. The recreation center will offer students an unparalleled venue for these activities."

"There are many benefits the School and the Golden community will derive from the CSM recreation center," added McNeil, who served as president of the student body for the 1970-71 academic year. "For example, the center will allow the School to greatly expand its services to high schools throughout the state for athletic tournaments and other events, exposing Mines to an audience we otherwise would not have attracted to campus."

Recreation centers are increasingly important features on campuses nationwide as today's applicants evaluate the overall campus experience – especially social and recreational opportunities – in choosing a school. A recent study of 700 colleges and universities conducted by the National Intramural-Recreational Sports Association indicated that nearly half of the schools were planning or currently involved in major recreation center construction or improvement projects. The competition for top academic and athletic performers is intense and colleges are leveraging high-tech recreation facilities to attract the most accomplished candidates.

The new Mines recreation center will house a 2,500-seat competition arena, a 25-meter swimming pool and aquatics area, a large recreational gymnasium, a climbing wall, a cardiovascular and weight room, an indoor jogging track and ample space for students to socialize.

Mines has already secured \$20 million of the \$25 million needed for the project, including the land upon which the facility will be situated. The School is counting on the generosity of its most loyal friends and alumni – and the dedication of committee members like McNeil and Isaacs – to raise the remaining funds.

"A comprehensive program of athletics, recreation and fitness activities is integral to the Colorado School of Mines experience," said President John Trefny. "The entire Mines community is grateful for the recreation center committee's gifts and efforts to appeal to their peers in the resources industry for additional project support."



Bud Isaacs

Recreation Center Committee

Marv Kay '63, Chair
Chuck Baroch '54
Mike Cruson '65, '73
Jim Dunn '64
Damian Friend '75
Bud Isaacs '64
Ben Mares '73

Charlie McNeil '71
Leslie Pagels '79
Art Pansze '63
John Rossi '61
Frank Stermole
George Wayne '85, '92
Bob Writz '64

For more information on the recreation center project, please contact any member of the committee or Rod McNeill through the CSM Foundation at 303-273-3161.

Become a Sustaining Member of the Alumni Association

- ANNUAL MEMBERSHIP**
\$55/yr for '02 and earlier grads;
\$100 for two years ('05 & '06)
\$30/yr for '03 & '04 grads — \$54 for two years ('05 & '06)
- JOINT MEMBERSHIP** (both spouses alumni)
\$65/yr for '02 and earlier grads;
\$120 for two years ('05 & '06)
\$40/yr for '03 & '04 grads — \$70 for two years ('05 & '06)
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\$1000 or \$200/yr x 5 years
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You must have been a sustaining member for at least 15 years.

Contributions to CSMAA are deductible under Section 504(C)(3) of the Internal Revenue Code. In accordance with IRS guidelines, the CSMAA Alumni Association provides no goods or services in exchange for your gift. CSMAA funds are not part of the Mines Annual Fund.

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Golden, CO 80402-1410

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Signature _____
Exp. Date _____
Acrcunt _____
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 Check enclosed (make out to CSMAA)

production engineer for BP Exploration.

Christopher Cody Duran BSc Chem Eng is a senior technical professional for Halliburton Energy Services in Williston, N.D.

Matthew J. Krugman BSc Eng, MSc Engr Sys '04 is an engineer for Acroname Robotics in Boulder, Colo.

Eric K. Lorensen BSc Geol is a geological and environmental engineer for AMEC Earth & Environmental in Lakewood, Colo.

Ryan T. McHugh BSc Met & Mat Eng is an analyst for Huron Consulting Group in Chicago.

Paula A. Oransky BSc Eng is a sales manager for Cemex in Highlands Ranch, Colo.

Ananth Srinivasan MSc CPR is an applications engineer for Hughes Baker INTEQ in Houston.

Eric B. Tidd BSc Eng is a project engineer for CAS Engineering in Mount Airy, Md.

Nhatran H. Tran BSc Pet is an attorney for Davis, Graham and Stubbs in Louisville, Colo.

Jonathan A. Woolley BSc Geop, MSc Geop '04 is a geophysicist for ConocoPhillips in Houston.

2002

Jesse J. Adams BSc Met & Mat Eng is a process engineer for CoorsTek in Golden, Colo.

Marco I. Alvarez-Bastos PhD Geol is geology department head at Universidad Industrial de Santander in Colombia.

Raymond A. Bolter BSc Eng is MWD specialist for Baker Hughes INTEQ in Broussard, La.

Jonathan B. Casten BSc Min is a mine engineer for Black Butte Coal in Point of Rocks, Wyo.

Andrew R. Depperschmidt BSc Phy, MSc Engr Sys '04 is a mechanical engineer for Washington Group International in Denver.

Gwendolyn E. Eberhart BSc Eng is city civil engineer for Durango, Colo.

Michael R. Fellingner BSc Phy, MSc Engr Sys '04 is a graduate student at Ohio State.

Jon B. Froderberg BSc Eng is an engineering technician for Intermech in Richland, Wash.

Benjamin A. George BSc Geol, MSc Geol '04 is a geological engineer for Cornforth Consultants/Landslide Technology in Portland, Ore.

Adam D. Goodworth BSc Eng, MSc Engr Sys '04 is an engineer with JR Engineering in Denver.

Forrest F. Guest BSc Math & Com Sci is a technical support engineer for Taxware in Salem, Mass.

Jeremy J. Hamer BSc Eng is a civil engineer for Haeger Engineering in Rolling Meadows, Ill.

Wesley B. Harbert BSc Eng is a land development engineer for Consul-Tech Development Services in Ocoee, Fla.

Niles R. Heier BSc Eng is a project engineer for the Murphy Company in Denver.

Grant N. Hester BSc Eng is a mechanical design engineer for Seagate Technology in Longmont, Colo.

James J. Hochnadel BSc Met & Mat Eng is umbilicals engineer for ChevronTexaco in Bellaire, Texas.

Dayven H. Johnston BSc Min married Chelsea Leiner last August on the Isle of Capri, Italy. He is mining sales representative for Caterpillar in Nashville, Tenn.

Erin L. Justen BSc Met & Mat Eng, MSc Met & Mat Eng '04 is a process engineer for Intel.

Ellen J. Klein BSc Eng is a mechanical engineer for Enermodal Engineering in Denver.

Joshua D. Leasure BSc Eng is an acoustical engineer for Hankard Environmental in Fort Collins, Colo.

Jennifer A. Lien BSc Eng is a transmission line designer for Black & Veatch in Ocoee, Fla.

W. David Miller BSc Eng is a field engineer for GE Healthcare in Westminster, Colo.

Malia L. Miranda BSc Met & Mat Eng is a metallurgical engineer for Paccar in Marysville, Wash.

Craig H. Neuman Jr. BSc Eng is air quality project manager for URS in Freeport, Texas.

Lindsey A. Ozark BSc Eng is an engineer for Southern California Edison.

Mark A. Ruthven MSc Eng & Tech Mgmt is a program director for Technology Innovations in Arvada, Colo.

Daniel A. Staley BSc Eng is an engineer for Kiewit in Denver.

Benjamin M. Upsall BSc Geol is a geotechnical engineer for HartCrowser in Seattle.

2004

Steven R. Adams BSc Pet is a projects engineer for Crest Energy Consultants in Canada.

Garrett J. Atkins MSc Met & Mat Eng is a welding and materials engineer for ExxonMobil in The Woodlands, Texas.

Naing Moe Aye BSc Pet is a junior engineer for Nautilus Resources in Denver.

Salah Ahmed Ebraheem Badr DSc Min is a lecturer at Al-Azhar University in Egypt.

Ella M. Cooke BSc Eng is a field engineer for M.A. Mortenson in Denver.

James W. Knight-Dominick MSc Min Ec is senior investment analyst for Madison Capital Management in Denver.

Michelle L. Kucharyson BSc Eng is project engineer for TST in Denver.

Saw Ler Mu Pro MSc Pet Reservoir Sys is a senior engineer for Myanmar Petroleum Resources.

Sebastian Olmos M Eng Pet is a reservoir engineer for Tecpetrol in Buenos Aires, Argentina.

Kimberly M. Stevens MSc Geol is a geoscientist for ExxonMobil in Houston.

JUST WHEN YOU THOUGHT COLORADO SCHOOL OF MINES HAD ACHIEVED EXCELLENCE IN EVERY POSSIBLE WAY,

THIS YEAR'S FOOTBALL TEAM MADE YOU THINK AGAIN.



Undefeated in the regular season, the Colorado School of Mines football team won the 2004 Rocky Mountain Athletic Conference Championship. Mines I lead Coach Bob Stitt was honored as Coach of the Year. And Quarterback Chad Frieauf won the Harlon Hill Trophy, giving him national recognition as the Top Player in NCAA Division II Football.

Student-athletes in other sports have also achieved a high level of excellence. Think about Hannah Davey. She won a national championship last spring in the 3,000-meter sleepchase at the NCAA Division II Outdoor Track and Field Championships. Davey is a top-notch student too, as is Frieauf. Both maintain a 3.5 grade point average.



Overall it's been an extraordinary year for Mines athletics, offering more intercollegiate athletic teams (18) than any other Division II school in Colorado. At the same time, admissions standards at Mines remain the highest of any public university in the state—and one of the highest in the nation. Prospects also remain excellent for graduating seniors, with a consistently high placement rate and an average starting salary of \$49,653.

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The Denver Post ran this advertisement in its Sunday, March 6, sports section. Paid for by the vice president of Student Life's office, the ad drew a rousing response from the community.

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E-Day 2005 included the cardboard boat races and this group included the most participants on board.