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Schlumberger

Slave the nation's leading recruiters of entry-level engineers, Schlumberger wants you to be aware of the alternative career opportunities awaiting you after graduation. Not all engineers sit behind a desk...

our Engineers end up in command...

As one of the nation's leading recruiters of entry-level engineers, Schlumberger wants you to be aware of the alternative career opportunities awaiting you after graduation. Not all engineers sit behind a desk...

Schlumberger engineers take command outdoors.

After an initial 6-month training program, you will have mastered the art of interpreting complex well logging data. You'll be an engineering consultant, troubleshooter and supervisor, working a continuous schedule of 9 days on call, then 3 days off.

To be considered, you must have a 4-year degree in ME, EE, PetE, Physics, or Geophysics. You must be capable of working long hours at remote oil and gas well sites. Your interpersonal skills must qualify you to be an assertive team leader as well as a diplomatic client consultant.

Your benefit package will include 21 days vacation, a company car, expense account and monthly bonuses.

At Schlumberger, we promote totally from within. We only hire those individuals who show us the potential to move up. If autonomy, self-reliance and decision-making are your strengths, you might find yourself at Schlumberger too.

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features

Comments . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .}
I would like to give my assessment of the current U.S. defense posture and what some of the trends are. The commentary that will follow is on the relationship of your industry to my defense industry, defense, will then be compellingly obvious to you. The theme that will dwell on is an unpleasant one for me, and I think unpleasant to all thinking America. Our position in the international pecking order, of military power, industrial power, economic, political, and economic power as it relates to the defense business is slipping badly. We are no longer the "arsenal of democracy." That Pres. Roosevelt correctly tagged us about 40 years ago. In fact, unless we had a very, very overpowering nu­

 torment, like TV's, radio, stereo equip­
 ment, electronic watches, parts, are imports from foreign sources to the point where Japan and Italy today can produce twice as much as we did in the early 1960's, as the time when our military people, not 850,000 people, completely vanished. The Air Force had more than five percent of the rest of the world combined. But I believe that that relative economic decline is slipping badly. We are no longer equal in military strength, that represents a net depravity in growth of about twenty percent. Those are facts. During those same ten years, our armed forces spending has decreased by an average of five percent in real terms—but in year in year out—even year. Another fact is that during those ten years, each year—in year and year out—all things considered, decline or remain stable. During the 1970's, Congress spending on things related to my business—that is, military research and development, military weapon systems acquisition, military production facilities—excels that which the United States spent by $240 billion. Last year the Soviets spent orange million, a decline of 40 percent in the 1970's, Soviet spending on things related to their industry, that is, economic and production sectors by half. For every helicopter, they produce two and a half. For every airplane, they produce three. They now surf to surface-to-air missles for every one we produce. They have a constant forward thrust which we lack, a constant forward acceleration, we lack that. I have been discussing the "baddies," the Soviets. Let's look at our friends, the nations and supra­

 bodies, are even more dependent on imports than are we. Let's take just one country of ours. We are totally dependent on imports for aluminum, tungsten, nickel, titanium, molybdenum, vanadium, molybdenum, magnesium, chromium, zirconium, as­

 tobit, and several other materials. That relative technical decline has caused me great pain. The fact that the Soviet Union is virtually independent of imported supplies in all of those materials and in fact a net exporter of some of them causes me even greater pain. The strategic implications of a situa­tion like that are not very good. The strategic implications are even more painful to contemplate if you add another fact, that the nations and supranational groups with which we are allied are even more dependent on imports than are we. And one last one, Germany, for example. They are totally dependent on imports for aluminum, tungsten, nickel, titanium, molybdenum, vanadium, molybdenum, magnesium, chromium, zirconium, as­

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hole per dollar, and shift after shift performance, with one of these percussion
Get the drop on any rock job
Rifle Bar Drifter Drills. These drills include separate control of
surface long hole or single pass
Drills. These tunnel and
Independent Power Rotation
contact your Gardner-Denver
Colorado 80201.
Representative. Or write us at
most pernicious other factor relates to
been germinating and maturing for a
second-rate industrial and mineral base.
think that we can maintain our position
everywhere.
We hear a lot of talk today about the need to accelerate our defense spending and the need to surge our acquisi
ions. Today appears to be a considerable segment in our
Congress determined to do something
to get defense hardware to the
in the field. But I am afraid that our near term capability to sur
is something quite steady, is mesmeric, and
the long term prospects aren't as grand as some people think.
I think we are on the right track on the way toward becoming a second-rate
industrial power. That concerns me as an American citizen and concerns
daingly deeply as a professional military man. I think it is a gross contradiction of the idea that we can maintain our position
first-rate industrial and mineral base, it has never been done in the history of the
world. The factors that underlie this
sorry situation aren't new. They have been germinating and maturing for a
long time. One of these factors is the state of our national mineral policy. The
most pernicious other factor relates to
the incentives to invest in modern plant and
equipment. Too few are positive, too many are negative, of poor
defense budgets in my business ad
versely affects us. Government over
regulation negatively affects defense. The lack of competitive pressure in
our business is a great factor in
militarily driven companies, and it
affects us, as do repressive profit
policies. Repressive inflation, interest
discounts that are very restrictive and
tax policies, are all dangerous for us.
In every one of these actions, even though many of them are totally, completely,
the problem is not so much in the things that we can do, but the problem is in the things that we can't do. That is a
total disincentive to long term
investment in new plant and
equipment. This proposed law would reduce
together the budgetary and the
environmental authority of the government officials. It would allow
advantages to material buyers for out-year
deliveries that we can't do now. It would
also raise cancellation ceilings on
to-lot orders.
In the area of contract financing, I have proposed some regulatory
changes which would allow us to
increase such things as progress
costs. It would allow us to
lower the interest rate for multiple
billings, which would provide
the criteria for an
approval of unusual progress payments and
other things, all designed to
improve the competitiveness for
productive enhancement ventures.
I am also attempting to get a regula
tory change with which we would have
the ability to include specific critical materials, raw
materials, that are either bought or
stock, with other long lead purchases, and to stockpile that within our
factories.
We have also worked with OSD, the
Office of Secretary of Defense, and with
FEMA on getting more national stockpile
policy. The stockpile policy through
Title II of the Defense Production Act,
must be revitalized.
Confidentially must be given to
enlarging the national stockpile of ex
panding our basic materials and
equipment. We are interested in a substantial increase in funding in our manufacturing tech
ology from $37 million this coming year
to $180 million in FY '88 as a constant
stress toward productivity enhancement
in the aerospace industry.
A group of mining industry executives
met with me a few months ago. I
found that we all viewed the situation with
alarm, we believe that we are
also hold similar meetings with
leaders of aerospace industry, and we are
scheduling a meeting with a national
labor leaders whose organizations en
compass
the industry with effects in my business.
All of these actions, even though
even one of them is totally, completely,
the problem is not so much in the things that we can do, but the problem is in the things that we can't do. That is a
But I will see us up to it! Well, that's the
68-4 question.
Our nation has been characterized through
time as having an aloof, aloof, aloof,
acceptance of the fact that we are second best.
I do not believe that things are great. We want to
convince our customers that things are
going to turn out all right in the end and
that the truth fairy is going to visit us
and leave that of that is done under
our pillow. It will not happen until we
make the whole commitment take place.
The key to our success or failure in
making things turn out all right is leadership
at all levels of government, in
industry, in the military, in
education. And lest you get the wrong idea,
I call myself as a dedicated optimist, a
tiny cynical, perhaps, but a dedicated optimist, in the cynical side of my
nature demands that I share with you
another conviction that pessimists are
generally more accurate in their fore
casts than optimists. But optimism about the future is reasonere because
good things as well as bad things happen. And God knows, we have had
enough bad things happen to us
in the past several years. It is time
for some good things.
There is a difficult and very rocky road ahead if we are going to get those
to make some bad things come true.
We have got to have the national sense of high purpose and
national will that has carried us through
many crises in the past. San. James
McClellan has written that the 20th
situation in your industry as being
of crisis proportions. I agree with that.
We will have to dust off our old
tradition, of hoping, of being second best.
We will have to take our old national trait of
unashamed, unapologetic patriotism out of the storage closest in the clost.
and we have to quit apologizing for being the
greatest country on earth.
We have to
to do our business in the longrun in the
Western world and get on with the job.
In short, we will have to do
acting once again like the great world power
that we still are and face up to the fact
that we have to continue to fulfill our responsibilities of the Western world's
power. We cannot shrink away from
those responsibilities. If we do, I think
our way of life and the freedoms that we
love will shrink away from us and we will deserve whatever sorry fate befalls us.
I would like to close with a quote from
the close of a speech made by Theodore Roosevelt three-quarters of a
century ago. He said, "The things that
destroy America are prosperity at any price, the love of sameness, thrift,
and the spirit that values labor above
rich—quick plenty of life."
He went on to say, "If we seek merely
swollen, slothful ease, and accept
something as true because it's old and
worn, we will pass by and will win for
nothing and deserve whatever the
domination of the world.
I have asked for a substantial increase
in the DOD budget for the next year.
That will provide for a major increase
in the DOD budget for the next year.
That will provide for a major increase
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in the DOD budget for the next year.
The Mining Department tops the list of departments at Colorado School of Mines which have received funding for contract research this year. That’s an enviable position from the point of view of the graduate students and the professors supervising this research. It is a vote of confidence by industry in the ability of the department to solve problems and provide answers. It is also a matter of some concern to the head of the department, Dr. Thys Johnson.

While Johnson is pleased with the variety of programs possible in the department because of this funding, he is also balancing this against other forms of research, particularly on an undergraduate level, and constantly weighing methods of integrating the funded research programs into the formal curriculum of the department.

Together with the professors with whom he works, the other faculty on campus, and information garnered from mining department alumni, Johnson is evaluating almost every area of the current instructional mode. The type of student, the number of short courses given for continuing education programs and the future of the department. This is quite an undertaking, and, coupled with the daily teaching load, administrative duties and other responsibilities, has kept the staff of the department locked into extra hours of study and consideration.

New Move

After decades of being quartered in Chauvenet Hall, the teachers, support personnel and students of the mining department expect a move into the magnificent new George R. Brown Mining and Basic Engineering Building. The range of opportunities for expansion in the new building is challenging for everyone, particularly in the areas of research. New equipment, provided for by commitments from Newmont Mining and Ingersoll Rand, will enable the department to move into hitherto impractical areas of research and study.

To better meet the challenges of the new surroundings and new facilities, the faculty is planning a few immediate changes, and planning for other, more significant changes in its program for later implementation.

One of Johnson’s concerns with the present curriculum is course design. He is evaluating what is currently missing in the course of study, hoping to add this material, and also to ascertain if there are overlapping courses. Recent additions to the curriculum addressing this problem are underground mine design and evaluation; advanced surface design; advanced bulk handling mining techniques and also emphasis on rock mechanics.

Other philosophical and practical questions with which the faculty hopes to find some help were presented in the November, 1980, MINES Magazine. Dr. Donald Gentry, head of the curriculum committee in the department, is anxious that the alumni of the department return and evaluate the questionnaire and all other factors currently being weighed in the program for later implementation.

The question constantly arises in engineering education, the importance of this training with its combinatorial advantage of understanding the requirements of industry, rather than the more traditional classroom training only.

While industry requirements have always formed the basis upon which the mining graduates have found employment, there has been an element of surprise present in the last few years not previously found. More fields, such as the greatly expanded computer application to mining, the expansion of engineering consulting firms and the necessity of much more concentrated research to find ways of utilizing resources, have been made available to the typical CSM mining graduate. In addition, these young mining engineers have been faced with the lack of incentive for young people to enter industry itself is partially responsible for the lack of incentive for young people to enter industry.

Chauvenet will be left behind soon, as the Mining Department moves to the new George R. Brown Mining and Basic Engineering Building.

Facility Enlargement

Facilities in the new mining building will also broaden the base from which the faculty and engineering students will benefit. With almost twice as much space available as before, a wide range of experiments in coal laboratory; coal preparation areas; vibration laboratory and rock mechanics will now be possible. Nearly 60 percent of the first floor of the building will be dedicated to rock mechanics study, with four testing machines available instead of one the 1 now in use. Provided by Newmont Mining, the equipment is of the newest design and includes a "1 million pound test setup.

Drilling facilities designed especially for the new building by Ingersoll Rand will open up exciting new possibilities in the teaching of that emphasis.

The fact that every professor in the department has spent usually at least a minimum of three years, and some much more, in the mining industry, Johnson stresses the importance of this training in the orientation to mining, the expansion of engineering consulting firms and the necessity of much more concentrated research to find ways of utilizing resources, have been made available to the typical CSM mining graduate. In addition, these young mining engineers have been faced with the lack of incentive for young people to enter industry itself is partially responsible for the lack of incentive for young people to enter industry.

The new building by Ingersoll Rand will open up exciting new possibilities in the teaching of that emphasis.

Dr. Donald Gentry feels that the curriculum adjustment, made upon the basis of the questionnaire and all other factors currently being weighed in the department, will have to be balanced with the ongoing School-wide studies of curriculum. He is concerned with the competence of the graduate in other areas besides mining, and particularly concerned with the motivational factors of students attending Mines. A special sort of person, Dr. Gentry feels, is attracted toward the profession of mining engineer. The nature of the work requires patience, dedication and a high degree of skill—which takes many hours of study and hard work to obtain. Background knowledge, even personally wide into the making of a good mining engineer he says.

Some similar thoughts are voiced by Dr. William Hustuufi, who says that the
eating, and, even among themselves, do not always transmit information essential to development and growth of the industry. Technical literature, in both quality and quantity, is improving. Hustrulid says. He sees a real improvement in the availability of hard information on research and new techniques, and the whole spectrum of mining development is being covered much more thoroughly. CSIM professors are contributing to this vastly larger pool of information with articles for textbooks and journals, with Dr. Robert Trant, of the mining department, being the latest. He is the author of a chapter in the new Society of Mining Engineers Handbook on Mine Plant Design.

Hustrulid agrees with Gentry that the mining engineer is often a very special person, coming from a special background. This has led, he feels, to a philosophy in the teaching of mining engineers which stressed descriptive, technical training for specific objectives. Or, is the reverse best? That is, do the schools put too much emphasis on broad training now, and should it be more narrowly focused? He also stresses that mining engineers and engineering technologists are not to be confused. There are schools of mining technology in the U.S., and there are engineering schools, such as CSIM. He suggests that in some cases, the company employing the graduate to complete specific training for specific object? Or, is the reverse best? That is, does the school put too much emphasis on broad training now, and should it be more narrowly focused? He also stresses that mining engineers and engineering technologists are not to be confused.
both master's and doctor's degrees, plus occasional labor of undergraduate students and other participants.

Another project at Mines is the development of a new mining technology, which involves the use of advanced computer models to predict the behavior of rock masses during mining operations. This project is being carried out by Hazen Research, Inc., which is one of the leading mining engineering research firms in the world. Hazen Research has a long history of developing innovative solutions for the mining industry, and their research is focused on improving safety, productivity, and sustainability in mining operations.

The project at Mines involves the use of computer models to predict the behavior of rock masses during mining operations. The models are based on advanced geotechnical analyses and are designed to provide accurate predictions of rock mass behavior under various mining conditions. The models are being used to evaluate the performance of different mining methods and to optimize the design of mining operations.

The project is being led by Dr. William Crowe Keilogg, who is the President of the mining company. Dr. Keilogg is a leading expert in the field of mining engineering and has published numerous papers on mining methods and safety. He is also a member of the NIOSH and the SME, and he has received numerous awards for his work in mining engineering.

The project at Mines is expected to have a significant impact on the mining industry, as it will provide mining companies with a powerful tool for predicting the behavior of rock masses during mining operations. This will help mining companies to design safer and more efficient mining operations, and it will also help to reduce the cost of mining operations.

The project is supported by the National Institute for Occupational Safety and Health (NIOSH), which is a government agency responsible for improving workplace safety and health. The project is also supported by the SME, which is a professional society for mining engineers.

The project is expected to be completed in the next few years, and the results of the research will be published in leading mining journals. The research will provide valuable insights into the behavior of rock masses during mining operations, and it will also help to improve the safety and productivity of mining operations.
In the Oquirrh Mountains' Pine Canyon of southwestern Utah, hard rock miners with pack mules, picks, and blasting primer cord crawled over craggy slopes to stake mining claims in the late 1890s. Abandoned tramway cable riggings and wooden ore bucket pulley towers are silent testimony to the incredibly hard work, slow production successes and limited ore recovery they endured.

Today, the Anaconda Co. is mining the same mineral lands with modern equipment, a technique called vertical crater retreat, laser beam technology, a gravity-based concentrator flow, metric measurements, and computer/cathode ray video terminals.

After a five-year, $216 million investment, Anaconda's Carr Fork Mine southwest of Salt Lake City at Tooele is producing about 4,000 metric tons per day of copper ore grading out about two percent net. Production began in September 1979 and by June 1981 approximately 10,000 metric tons per day will be mined routinely.

Nevertheless, the equation for success at Carr Forks today requires much the same as it did for the pick and pack mule brigades—2 percent copper, 98 percent hard work.

Anaconda's understanding is making use of some rare or first time mining circumstances. Art Ditto, project manager, says, Carr Fork, projected to have a 25-year lifespan, is one of the very few deep mines developed in the last 10 years in the United States. The mine is the first of its kind in the nation to be designed in metric measurements. Carr Fork is one of a limited number of deep mines which make use of a mining method called Vertical Crater Retreat (VCR). Large diameter holes are drilled from the top sill through the ore to an undercut draw opening. Explosive blast charges of ore downward to the undercut. The method retreats upward until the top sill is reached.

Other unique aspects include a gravity-based concentrator flow requiring only five process pumps. This system takes advantage of the slope terrain. One of the most modern engineering methods is a laser beam system. It is used at distances of between 3,000 and 4,000 feet. The laser beam is used to align haulage tracks to a one-half percent slope grade.

Track Key to Productivity

The track haulage system is considered a key element in the production process by Ditto and mine management personnel. More than 300 tons of 115-lb. rail and nearly 9,000 hardwood crossties, pressure-treated for longer life in wet underground conditions, were supplied by L. B. Foster Co. Foster specializes in rail, pipe, piling, construction equipment and fabricated products.

Anaconda's Carr Fork Mine utilizes a blend of manpower and computers. Project development and actual mining necessitates a workforce of 700 to 800 persons, the majority of which are miners. Anaconda operates its own miners training classes in which trainees are screened, selected monthly, paid for class work and classified. The goal is to fill the necessary 550 miners jobs to operate three and four man crews, three shifts a day, seven days a week.

Computers Quantify Progress

Approximately 25 video display terminals are in use throughout the various departments to provide quick access to a variety of facts, figures, charts, projections, and design ramifications. It allows personnel of several departments access to relevant data. Several computer systems have been used already, and more are scheduled to keep pace with mine growth.

Heavy Duty Trains Used

Two trains of Asia's 12-cubic-meter capacity cars are being used in the haul runs. Each train is composed of 20 cars and is moved by two General Electric 30-ton locomotives. The trains can be controlled from either the front pulling locomotive or the rear pushing vehicle. The second unit responds automatically to the operator's commands. The trains also can be controlled by radio commands transmitted by an operator at the loading chute.

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alumni update

39 William F. Dieter, E.M. and Metallist 
'77, with Claxom Metals Corporation, was a member of the AMC Mining Convention held in San Francisco last September.

40 James D. McCullough, E.M., formerly manager of geophysics for Geostrata Exploration Co. in Houston, has been appointed to the AMC Mining Convention program committee.

41 Robert J. Black, Geol., formerly chief geologist for Jardine Exploration Co., is now manager of geophysics for Weaverton Exploration Co. in Houston.

42 Stanley C. Holmes, '52 E.M., of Occidental Exploration Co. in Houston, has been promoted from mine production superintendent for Aminoil USA, Dodge Corp., was a member of the AMC Mining Convention program committee and presented an employment as a geological consultant in oil exploration.

43 James B. Smookler, MSc.Pet., P.E. and MSc.Pet. '70, formerly coal exploration geologist for Marcellus Inc, of Denver Voyager as operations manager, has joined Noranda Minerals Inc, of Denver as a geophysicist.

44 John R. Quackenbush, P.E., formerly business development representative for Geostrata Exploration Co., is now manager of safety and land development for Aminoil USA.

45 Raymond J. Wilbur, BSc.Min., has joined Durango Exploration Co., as project engineer in Pinehurst, ID.

46 J. Cooper, P.E. and MSc.Pet. '70, formerly development geophysicist for Geometries Inc., Denver as a geophysicist, has been appointed to the AMC Mining Convention program committee.

47 Barbara D. Quackenbush, P.E., formerly manager for Technico Consulting Engineers in Denver as a geophysicist, has been appointed to the AMC Mining Convention program committee.

48 Stanley Smookler, MSc.Pet., is now manager of petroleum geology for Technico Consulting Engineers.

49 Thomas Augustine, P.E., is now manager of petroleum geology for Technico Consulting Engineers.

50 Robert W. Wunder, BSc.Geol., has been promoted from mine production superintendent for Fluor Drilling Service in Irvine, CA to general manager to vice president of Fluor Drilling Service.

51 Thomas M. Valente, '53 Geophysicist 

52 Irish McKeever, Jr., Geol., was a member of the AMC Mining Convention program committee.

53 Stanley C. Holmes, E.M., of Phillips Dodge Corp., was a member of the AMC Mining Convention program committee in 1980.

54 John R. Quackenbush, P.E., formerly business development representative for Geostrata Exploration Co., is now manager of safety and land development for Aminoil USA.

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60 Thomas M. Valente, '53 Geophysicist

61 Edward J. Johnson, '49 Petroleum Geology

62 Dr. Thomas R. LaFehr, MSc.Geol., chairman of Exploration Data Consultants, Inc., of Denver, has been appointed to the honorary chairmanship of the 1981 Geophysical Society of America's Geophysical Seminar.

63 Thomas R. LaFehr, MSc.Geol., has been appointed to the honorary chairmanship of the 1981 Geophysical Society of America's Geophysical Seminar.

64 John R. (Jack) McNinn, '42 Petroleum Engineer Operations and Management Consultant

65 Barry D. Quackenbush, P.E., formerly manager for Technico Consulting Engineers in Denver as a geophysicist, has been appointed to the AMC Mining Convention program committee.

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68 Thomas M. Valente, '53 Geophysicist

69 Jerry R. Burgess & Assoc. 

70 Robert D. Wunder, BSc.Geol., has been transferred from Kentwood Copper Corp., where he was a geologist, to Kentwood's Bingham Mine, NM, where he is currently employed as a manager of exploration.

71 Christopher Bobbit, BSc.Min., has joined Westbridge Resources as exploration analyst at Oak Valley Copper system to engineer for that same company.

72 Thomas W. Hayes, BSc.CPP., has joined Texas Gulf as manager of project engineering.

73 Barry D. Quackenbush, P.E., formerly manager for Technico Consulting Engineers in Denver as a geophysicist, has been appointed to the AMC Mining Convention program committee.

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CSMMA Honorary Membership

The CSM Alumni Association annually confers honorary memberships in the Association on individuals who have been of significant service to the Colorado School of Mines and its Alumni. In addition, the Alumni Association recommends candidates to the Association Board of Directors for final selection.

Several criteria are used in selecting individuals for this honor. These are:

• The recipient must have rendered distinguished service to the Association and/or the Colorado School of Mines.

• The recipient must not be a graduate of the School of Mines.

• The recipient should be able to present in person to receive this honor at the May 1981 Commencement banquet.

Please submit your recommendations for this honor to the Honorary Membership Committee, Alumni Association, Guggenheim Hall, Golden, CO 80401, prior to January 1, 1981. Please include a brief synopsis on the background and service of each individual with your recommendation.

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the mines magazine • december 1980

the mines magazine • december 1980
Energy-efficient operation of the internal combustion engine requires the highly turbulent movement of fuel and air in the chamber. Recent advances at the General Motors Research Laboratories provide a new basis for determining what degree of turbulence will get the most work from each drop of fuel.

**Without Turbulence**, the highly agitated motion of cylinder gases, combustion would take place too slowly for the gasoline engine to function. Predicting combustion behavior in order to design engines with greater fuel efficiency depends upon understanding the relationship between vital, turbulent gas motions and burning rate. The challenge is to quantify this relationship—a complex task made more difficult by the requirements of measuring a transient event occurring in a few milliseconds within a small, confined space.

New knowledge of how turbulence affects flame speed has been revealed in fundamental studies conducted at the General Motors Research Laboratories by Drs. Frederic Matekunas and Edward Groff. Their investigative results have been incorporated into a model that successfully predicts the effect of engine design and operating conditions on power and fuel economy.

The researchers separated their experiments into two phases. In the first phase, they measured turbulence in the engine cylinder; in the second phase, they determined flame speeds over a broad range of operating conditions. Testing took place in a specially designed, single-cylinder engine equipped with a transparent piston to permit high-speed filming of the combustion event.

Hot-wire anemometry was applied to measure the turbulent flows while the engine was operated without combustion. Instantaneous velocities were calculated from the anemometer signals and simultaneous measurements of gas temperature and pressure. More than 400,000 pieces of data were processed for each ten-second measurement period.

The significant measure of turbulence is its "intensity" defined as the fluctuating component of velocity. Because conditions in the cylinder are both transient and spatially complex, separating the fluctuating and mean components of velocity is inherently difficult. The researchers overcame this problem by using a probe with two orthogonal wires properly aligned with the direction of the mean flow.

In the combustion phase, tests were performed at over one hundred operating conditions of varied spark timing, spark plug location, engine speed and intake valve geometry. Detailed thermo-dynamic analyses were applied to the recorded cylinder pressures to calculate flame speeds throughout combustion. High-speed films were analyzed frame by frame to isolate flame speeds and to characterize how gas motions influence the initial flame.

The researchers used these measured flame speeds, turbulence intensities, and the conditions under which they occurred to formulate a burning law for engine flames. They divided the combustion event into four stages. The initiation stage begins with ignition and ends as the flame grows to consume one percent of the fuel mass. In the second stage, the flame accelerates and thickens in response to the turbulent field. The third stage exhibits peak flame speed. In the final stage, the thick flame is compressed increasingly with the chamber walls and decelerates.

In predicting the energy release rate from the burning velocity equation, it is necessary to account for the finite flame-front thickness. "The form of our burning equation," says Dr. Matekunas, "shows a satisfying resemblance to expressions for non-engine flames. This helps link complex engine combustion phenomena to the existing body of knowledge on turbulent flames."

We see this extension," adds Dr. Groff, "as a significant step toward optimizing fuel economy in automotive engines."

\[ \text{S}_{\text{L}} = 2.0 \text{S}_V + 1.2 \alpha' \text{P}_A^{0.4} \beta \]

\[ \alpha' = \frac{\text{S}_V}{\text{S}_{\text{L}}} \]

\[ \text{P}_A = \frac{1}{1 - \frac{\text{S}_V}{\text{S}_{\text{L}}}} \]

O VER THE RANGE of turbulent intensities encountered in engines, the researchers were able to describe the turbulent burning velocity, \( \text{S}_{\text{L}} \), during the critical third stage of combustion with the expression:

\( \text{S}_{\text{L}} = 2.0 \text{S}_V + 1.2 \alpha' \text{P}_A^{0.4} \beta \)

\( \text{P}_A = \frac{1}{1 - \frac{\text{S}_V}{\text{S}_{\text{L}}}} \)

\[ \alpha' = \frac{\text{S}_V}{\text{S}_{\text{L}}} \]

\[ \text{S}_V = \text{Laminar flame speed} \]

\[ \text{L} \]

\[ \text{S}_{\text{L}} \]

\[ \alpha' \]

\[ \text{P}_A \]

\[ \beta \]

\[ S_{\text{L}} \]

\[ S_V \]

\[ \alpha' \]

\[ P_A \]

\[ \beta \]
PETROLEUM ENGINEERS

The Southern California Gas Company, the largest distributor of natural gas in the nation, has excellent career opportunities for individuals interested in reservoir engineering and drilling.

RESERVOIR ENGINEER

The individual will provide staff expertise in general reservoir engineering studies of underground storage fields owned and operated by the company. This will include doing material balance calculations, developing procedures and techniques for reservoir management, preparing field-related reports, and updating reservoir computer models.

DRILLING ENGINEER

The responsibilities of this position include planning and executing the drilling of new wells and the remedial work required on existing wells. This involves establishing cost estimates, designing rigging and well equipment, ordering materials, developing drilling and remedial programs, obtaining necessary permits, preparing reports, and monitoring reservoir changes to maximize production. This position also involves maintaining equipment, monitoring and reporting drilling and industry expenses to drilling and workforce managers, and acting as a mentor to new engineers.

G. H. Bryant, '53
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sections

New York

The New York Alumni Chapter hosted Dr. Guy McBride, CSM President, and C. W. "Bud" Leeds, CSM Foundation, at the Pinnacle Club on October 2, 1980. Ralph Honnembach, '41, made the arrangements. Dr. McBride outlined "CSM 1900-81" and responded to a number of Alumni questions.

Those attending included Charles Irish, '50, president; Newell Ox, '54, corresponding secretary; Jack Bell, '49; Peter Bergen, '56; Bill Breeding, '39; John Chandler, '59; Peter Dorrivan, '63; Van Donohoo, '39; Jim Endscoft, '54; Herb Goodman, '48; Ralph Honnemach, '41; Bob Howe, '33; Kurt Linn, '52; Ted Nelson, '34; Horbert Orton, '53; Don Roberts, '41; Allen Schneble, '63; Jay Siplkamor, '69; Ned Wood, '45; George Wunder, '36; Bill Yopp, '56; Joan Irish; Michael Joyce; Olin Foundation; and Bill Dinsmore, Texaco, Jr.

FOR THE UNITED STATES BUREAU OF RECLAMATION

HARRISON WESTERN IS CONSTRUCTING A SYPHON PIPELINE AT THE GRANITE CREEK PROJECT, NEAR BASALT, COLORADO

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- Pipe trench excavated on slopes greater than 100% grade
- Pipe laid on slopes greater than 100% grade
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- Excavation of concrete placed by helicopter
- Construction cabling single span of 3600' foot
- With a height at midspan above the canopy floor of 300 feet

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The mines magazine • December 1980
Dear Mrs. Petty,

I attended the alumni luncheon at the Hilton (San Francisco) yesterday and picked up a copy of the September issue. My request for identification of those in the picture on page 31 is the reason for this letter. Both my Mother and Father would be angry if I didn’t identify Dad in the front row. I have annotated a photocopy of the print with his face circled. I also noted that Underwood was Underhill.

This picture brings back a lot of great memories and I hope to get the chance to see some of these fellows at the 50th reunion. Long time, no see.

Ezeli Flournoy, ’32

Dear Mrs. Petty,

Enclosed is a copy of the picture that appeared in the September Mines Magazine; also a list of names that are my recollection of the men shown. There are other familiar faces but I can’t fit them all in.

This is just a partial answer to your question—who are these men? Maybe someone else can add a few more names.

Sincerely,

Art Austin, ’32

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Dear Mrs. Petty,

I have just read your article in the September Mines Magazine—it gets here a little later now that it comes by air. I refer to the article entitled “Construction and Philosophy.” I am not an authority on either construction or philosophy, but the article deals well also with the subject of foreign operation. In the field of foreign operation, I am not an expert, but I have had some experience. I think it is important to recognize the differences involved from a position of strength.

United States corporations abroad represent not only an economic system but also political and moral-cultural systems. They are agents of democratic capitalism and unless they can understand and reconcile these contradictions, they will not survive. Of course, there are other factors upon which survival depends. Useful governments in the development of governments which have adverse political and economic conditions threaten the corporate operation. From this short discussion it is immediately obvious that there are risks involved beyond the successful operation of the business itself.

To the Students:

I was quite interested in our recent conference in Keystone, Colorado, in the discussion of international trade and business practices. There was a lot of time spent on the morality of business, both at home and abroad. In your independent modern, diversified, pluralistic society, international business lacks a basic dimension. Since the business will be involved in international trade, a few thoughts in our student periodical are in order. First, a few definitions of terms which will be used as listed below.

1. Modern social order—This order is composed of Christians, Jews, Muslims, Buddhists, atheists, and others who all have a heritage from their respective social systems, a political system, an economic system, and a moral-cultural system. These systems will be influenced by each other. This influence should never be so strong as to subvert one to either of the others.

2. Societal societies—These societies are those in which all social and economic systems are controlled by the state or the governing body.

3. Corporate societies—The corporation is an invention of this age which has made democratic capitalism possible. A corporation is a social institution larger than the individual but smaller than the state. Its purpose is to provide continuity which transcends the life span of the participants. Its purpose is to serve the interests, ambitions, and cooperation of the individual participants, provide accountability to their owners, and ensure that profit will continue to exist.

When one considers taking a job abroad, you will undoubtedly be employed by a corporation. The business involved will be carried on under a minimum of two sets of national laws (U.S. and host country) in an environment which will be operated under a different vision of society, culture, and religion, and probably in a language different from English. There are formidable obstacles to contending for a new graduate.

In my experience, the first prerequisite is to enter into such a job with an open and inquisitive mind. You have as basic tools your engineering education which is second to none. You can deal with technical problems involved from a position of strength. Second, you have a heritage from your own country. Your home world has emphasized the value of importance of the individual. These have been two basic and reasonable health and vigor you should be able to face international competition with confidence.

The remaining factor of communication in your new environment is a problem. Usually there are other Americans in the operations as well as many nationals of the host country. You have two choices. Either stay isolated and never understand, or try to learn the language and customs of the host culture and prepare yourself to live a broader, fuller, and more useful life.

The actual operation of a business in a foreign country requires accommodation to the local governing laws. It is usually untrue to attempt to impress American business, political, and cultural ways on the host people. One thing, however, is usually favorable. The fact the business is located to locate and operate in the host country means it is perceived to be needed. The degree of accommodation which a company achieves in the host country usually measures the success it achieves and its continuity. It must be valuable to the host country or it will not survive. Of course, there are other factors upon which survival depends. Useful governments in the development of governments which have adverse political and economic conditions threaten the corporate operation.

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Sincerely,

T.A. Manhart, ’30

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Editor’s Note: The foregoing letter was a “Letters to the Editor” of the September issue. It pictured the mining industry as a moving force in the Energy Advocates, dedicated to defending information on the economy.

Dear Mrs. Petty:

I enjoy the MINES Magazine, and I always enjoy the MINES Magazine, and I always enjoy the MINES Magazine. In my experience, the first prerequisite is to enter into such a job with an open and inquisitive mind. You have as basic tools your engineering education which is second to none. You can deal with technical problems involved from a position of strength. Second, you have a heritage from your own country. Your home world has emphasized the value of importance of the individual. These have been two basic and reasonable health and vigor you should be able to face international competition with confidence.

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Dear Mrs. Petty:

I have just read your article in the September Mines Magazine—it gets here a little later now that it comes by air. I refer to the article entitled “Construction and Philosophy.” I am not an authority on either construction or philosophy, but the article deals well also with the subject of foreign operation. In the field of foreign operation, I am not an expert, but I have had some experience. I think it is important to recognize the differences involved from a position of strength.

United States corporations abroad represent not only an economic system but also political and moral-cultural systems. They are agents of democratic capitalism and unless they can understand and reconcile these contradictions, they will not survive. Of course, there are other factors upon which survival depends. Useful governments in the development of governments which have adverse political and economic conditions threaten the corporate operation.

From this short discussion it is immediately obvious that there are risks involved beyond the successful operation of the business itself.

Sincerely,

T.A. Manhart, ’30

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Editor’s Note: The foregoing letter was a “Letters to the Editor” of the September issue. It pictured the mining industry as a moving force in the Energy Advocates, dedicated to defending information on the economy.
Glen was more onerous than the tax I had to pay. In both cases, making out the return was a very minor task but do not remember whether I had to pay anything at all. I paid $15,000 for four months work in Panama, in foreign income tax and never was I required to pay U.S. Income Tax. In 1958, I paid a few dollars for 10 months work.

Unfortunately, the situation has been changing recently. Latin American governments, for example, have recently cut themselves in for substantial participation in the exploitation of natural resources. They have also had a tendency to model their income tax laws after U.S. laws adopting the thesis that they need the money to support increasing bureaucracy. In the Dominican Republic, the State first imposed exorbitant income taxes. As a result, many people decided not to report their income, and the tax revenues were very low. In 1978, they imposed exorbitant income taxes, demanded by grants from international organizations. They have done this in many subtle and unobtrusive (?) ways. Maybe not completely legal.

A number of people have told me that they did not pay their income tax because they did not feel that they had a responsibility to do so. They felt that the government was not providing enough services for the money that they were paying in taxes. This is a common problem in many countries around the world.

Patsy Wegner was Mines' first such director. She was based in Colorado Springs and had a significant impact on higher education in the West. She was able to bring in more revenue and improve the programs at Mines. She was a strong leader and was able to make a positive difference.

In the audience was Colorado School of Mines President Guy T. McBride, Jr., sharing a moment of congratulations with Patsy Wegner, Mines' first such director, when she earned her Ph.D. in Student Personnel Administration. While Patsy and Guy were there to congratulate the new graduates, there was also an opportunity to meet old friends and enjoy the festivities.

Wegner's legacy continues to be felt today. The University of Northern Colorado has named an academic building in her honor, and the National Western Conference has established a scholarship in her name. The Colorado School of Mines has also established a scholarship in her name.

Some of the expanded programs include a new counseling office, development of a campus-wide counseling network, stress management workshops, leadership seminars and work on an alcohol abuse program for students. All of this grew in four years. They have worked hard to make sure that students have the resources they need to be successful.

Many students who want and need those services have not been able to access them. One of the key factors in this success has been a strong emphasis on student services and support. This has led to increased participation in student organizations and greater retention.

Patsy Wegner was a remarkable figure in the field of student services. Her impact on higher education in the West is undeniable. She was a true leader and a inspiration to all those who had the privilege of working with her. Her legacy will continue to be felt for years to come.
“There’s gold in them there hills!” not gold only. But silver, zinc, copper and moly. But gold was gold! GOLD! GOLD DISCOVERED IN COLORADO TERRITORY! That was the story. Late in the year of ‘58, It made the news both east and west! And caused a lot of men (and boys) to come. In dirty overalls and pleated vest. The rich, the poor, the young, the old. They cuss in search of gold. “I’ve gold in them there hills!”

From the streets of St. Louis, the fame of Missouri. The black coal pile of Kentucky, by foot and buggy. On horse and mule they came, With shaving and a golden pen. And a mountain full of dreams They came in search of gold. Andlush tomatoes ‘49ers back from California Would by their luck again. Johnny Coley was a luckless ‘49’er in. He headed on down Tincup way.

Timberline Out of the creeks and aspen groves, through In cracks and fissures, with quartz and amethyst. They mined the gold and threw away That heavy black gangue. The gorging that ran on 26 surrouns to the ton. Silver, white gold, locked in sulfides they threw it out. Profit is incentive, Wherein there’s incentive there’s a way. From Black Hawk to Silverton, the Sunnysides. And Fool Roxana came on line To separate the silver from the musk and slime. Johnny Coley worked the Camp Bird mine. (When his stake was gone,) but didn’t like it. He staked a little claim up in the rocks. He headed for the pot of gold beneath the sawatch, Of early September, just a week before the afternoon shower. He packed his pack and set out for the mountains. From Durango to Silverton, Creede to Victor. From Durango to Silverton, Creede to Victor. He staked a little claim up in the rocks. He headed for the pot of gold beneath the sawatch, Of early September, just a week before the afternoon shower. He packed his pack and set out for the mountains.

Colorado Gold

“IT” was a thousand feet and more. The nature of their homes changed. Evening and morning became the same as shift workers changed. And men worked round the clock, his longer famers with callused hands. Digging gravel in the heat of day, but Miners; Miners and engineers, powder boys and steel driving men. Driving tunnels and sinking shafts, they started in for gold. They found it poor as dew, in vein and leaf In cracks and fissures, with quartz and amethyst. They mined the gold and threw away That heavy black gangue. The gorging that ran on 26 surrouns to the ton. Silver, white gold, locked in sulfides they threw it out. Profit is incentive, Wherein there’s incentive there’s a way. From Black Hawk to Silverton, the Sunnysides. And Fool Roxana came on line To separate the silver from the musk and slime. Johnny Coley worked the Camp Bird mine. (When his stake was gone,) but didn’t like it. He staked a little claim up in the rocks. He headed for the pot of gold beneath the sawatch, Of early September, just a week before the afternoon shower. He packed his pack and set out for the mountains. From Durango to Silverton, Creede to Victor. From Durango to Silverton, Creede to Victor. He staked a little claim up in the rocks. He headed for the pot of gold beneath the sawatch, Of early September, just a week before the afternoon shower. He packed his pack and set out for the mountains.

In 1859, the boom was on. The sound Of wooden wagon wheels on rutted roads was everywhere. As beaver ponds and aspen groves gave way To cousins chisels, and it didn’t have a day. With the dreams and stories. They brought the whiskey; but few, if any With the mining came the need for tracks With wooden pegs and square cut nails. Assayors, surveyors and engineers: (Engineers from Bishop’s Band’s school) They designed the shafts and computed the timbers. They mixed the chemical to float the metal, And made these tunnels need a thousand feet In solid rock. In ’78 a territory gave birth To a State. And out of Roland’s university was born The School of Mines. A gold mine. The Colorado School of Mines. A wealth of good learning, a hundred years And more. The news was silver now, more than gold. As auditors sprawled out damps along the mountain slopes. "Hey, Jim, Johnny Coley, have you heard? They shocked the miner make a couple miles down. In a fort that called the Silver Bell. You were close. Johnny, sure enough You were close. There was the crack of ’93. It shut the boom towns down, and closed a hundred mines. Destroyed a thousand dreams, and left a lot of wheat homeless. To stand a lonely guard. But the crash of ’93 didn’t hurt Johnny none. They buried him, somewhere, in ’92, Fifty eight and penniless, tired and lonely, Too. He headed for the pot of gold beneath the rainbow. Hung in the sky, after the afternoon shower. Jim Evans, September, just a week before the snow.

Our saga features these men. And their friends, and families, and their dreams. They were the miners. The narrow-gauge miners. The men who made the Colorado Gold. This is their story. And the story of the Colorado Gold. A mining district that was as wild and free as the men who mined it. A mining district that was as tough and hard as the men who mined it. A mining district that was as rich and varied as the men who mined it. A mining district that was as unique and special as the men who mined it. A mining district that was as important and significant as the men who mined it.

Criteria for Award

A. Nominees should have the following qualifications:
1. The ability to present an interesting, informative, and challenging course.
2. Superior technical ability and knowledge as reflected in the presentation.
3. The ability to instill a sense of professionalism, integrity, and responsibility into the students.
4. The ability to motivate the student to think independently.
5. The ability to establish a relationship with the students based on concern and compassion.
6. Availability to students.
B. In comparison with other teachers, why is this professor outstanding and others not?

Eligibility

All full-time permanent faculty members are eligible for this award. The recipients of the award for the immediate past three years:
1977-78 Samuel B. Romberger, Geology E. Denny Sloan, Jr., Chemical and Petroleum-Ratcliffe Engineering
1978-79 Stephen R. Daniel, Chemistry and Geochemistry

Nominate Your Favorite Professor

David K. Matlock, Metallurgical Engineering 1979-80 Ruth Maurer, Mineral Economics

Submit your letter of nomination, following the above criteria, to Dr. William Mueller, V.P. for Academic Affairs, Colorado School of Mines, Golden, CO 80401. The winners will be presented at the April faculty meeting.

Unrestricted Grant

INLAND STEEL HELPS—The Colorado School of Mines metallurgy department received a $1,000 unrestricted grant from Inland Steel Company of East Chicago, Indiana. From left to right are William T. Mills, Inland Steel associate director of research; Dr. William Mueller, CSM vice president of academic affairs; Joe Manci, M.C.E. ’56, superintendent of Inland’s primary rolling mills and Dr. William Copeland, head of the CSM metallurgy department.

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Environmental Sciences Program

The Colorado School of Mines' Environmental Sciences Program is offering a series of courses this spring that cover a host of environmental issues, problems and solutions. The program is the only one of its kind in the state and specializes in information that is readily utilized by business and professional people. Courses are scheduled for once a week, one to four hours in the evening.

Course titles include:
• Fundamentals of Life Sciences
• Ecology Field Camp for Engineers
• Air Pollution—"Control and Technology"
• Seminar in Environmental Sciences
• Environmental Impact Statement Preparation
• Special Problems in Environmental Sciences
• Biological Oceanography and Marine Pollution
• Toxicology of Metals, Fuels and Industrial Substances
• Readings in Environmental Sciences
• Analysis of Environmental Problems
• Current Topics in Environmental Analysis
• Investigations in Environmental Science
• Energy, Environment and Natural Resources Law
• Ecological Considerations in Industrial Site Planning

The courses will be taught by a faculty group led by Dr. Beatrice E. Willard, professor of environmental sciences and director of the ES program. Willard's expertise is in plant ecology, particularly high tundra studies, in which she is a recognized authority.

She is backed up by Dr. John C. Emrick, an environmental biologist with a special focus on environmental impact on the marine environment.

Dr. Gregory R. McArthur has an extensive background in plant and environmental biology, and has developed new computer techniques for site selection and reclamation projects.

Finally, Roger P. Hansen, a Colorado attorney, has had extensive experience in environmental impact analysis, land use planning, environmental law and environmental permitting. His specialty is creating and managing interdisciplinary teams of scientists and technical specialists.

For further information about class descriptions, schedules, course credit and enrollment costs, contact the Environmental Science Program at the Colorado School of Mines, Golden, CO 80401, or call Jean Shadwell at 279-0300, extension 2427.

Prank Time

Jim Shaughnessy found his office strangely decorated on Halloween morning. Shaughnessy is purchasing agent for the CSM business office in Guggenheim Hall.

You did WHAT at Homecoming?!

Above, students from the Single Student Housing Association show that residence hall living can get pretty "primitive" at times.

At right, the Orediggers get set to hand the Western New Mexico Mustangs a 41-10 drubbing.

Above, students demonstrate why there are three industries in Golden: CSM, Ooms and the pipeline industry. (Photo by Mike Leach)

Above, an Oredigger band member ducks back through the crowd for a look at the homecoming parade.
**Sports Wrap-Up**

**Cross Country**—The Oredigger cross country team is extremely young. Coaches have promised to evolve into a powerful team in years ahead. In front, left to right, are Steve Landstra, Mike O'Brien, Phil Hefli, Andy Jones, Bob Morrie, Dave Lish and Coach Joe Davies. In the middle row are Greg Boldt, Muhammed Ujma, Todd Grimmett, Robert Hayden, Randy Ellis, Dave Patterson, Kurt Laufeld, Brian Swanson, Tom Young, Mark Bartin, Mike Stallings, Bob Woods and John Kell. Back are Ward Merhock, Tex Techin, Mark McDermott, Rich McDondall, Tom Halvorson, Lance Johnston, Matt Bergner and Jorge Lue, team captain.

**Mines Tennis**

The duo of Ted Dikmen and Mike Murray of the Colorado School of Mines tennis team took third place last weekend at the Michieლ Light Tennis Tournament in the men's collegiate competition. Mines competed against 14 Colorado universities and colleges, at the Gales Tennis Center in Denver. Dikmen is a freshman Oredigger, and halts from Regis High School, where he took second place in singles competition in the state tournament last year. Murray returns to the Oredigger fold after a year's absence from the tennis courts. Murray was a solid player for Cherry Creek in 1978.

The pair were the only Miners in the extensive competition which topped the singles, doubles (both man and women) and mixed doubles. While first off them out of the Michelle prize money, the pair did compete in doubles and song. Murray lost to Dudley Rheinbach of Mesa in singles, 6-1, 6-4, then dropped the consolation round to Davis Schroeder of Regis University. Murray and Dikmen romped over the Regis duo of Bolst and Towanyeff 6-1, 6-2. The Miners then held on to beat Pioneers Radoslav and Brodenick 6-4, 7-6 and 7-5.

CISM tennis Coach Jack Hancock feels that this is not the only harbinger of better things to come in the 1980-81 spring season. "I think it really started last spring when we finished 8-1 on the season and took a step up in the RMAC," he said.

According to the Oredigger coach, a 32 man team bracket (double elimination) began September 5th to determine the six best players for the fall season. "Surprises have been the rule, rather than the exception," said Hancock.

The survivors include Brian Housman—a last year's top seeded single; Jeff Bolke, Mike Murray, Todd Grimmart and Ted Dikmen. Freshmen standout Frank Gibbons could be the best of the returning seniors after tournament competition this week, noted Hancock. "Gibbons played the number one spot for Fairleigh Dickinson last year," said the coach.

**Rugby**

Denver's Dallas Rugby Club closed out the fall season October 28-29 by winning the Eastern Rockies Rugby Football Union's A-2 Division championship. The club's final record was 7-2-1, good for first seed in the division. Mines defeated CSU, 24-4, in the final and squashed by Ft. Collins RFC, 10-6, in a sudden-death overtime in the semi-finals on Saturday.

On December 3rd, the Miners took on the University of Texas at Austin, winning 20-14.

**Football Update**

Coach Marv Kay said about the Oredigger football team, "When we play well, we can play with anyone—when we don't play well, anyone can beat us."

Mines has had an up and down season. Against the Missouri College Mavericks Mines lost 20-14 after a game full of fumbles near the goal line and missed opportunities. The Orediggers came back to an upset victory over the Western State Mounties, 28-27. The Miners did not fumble, did not lose interceptions and managed to stop Western State when they really had to—one foot short of the goal line in the final seconds of play.

In the Western NCAA Conference Tournament the team won 41-10. The game, however, was full of errors for the Orediggers. Fortunately, for Mines, WNMU couldn't capitalize. The Orediggers won the passing battle and netted talent quarterback Mark Gill, who hit nine out of 12 for 176 yards and three touchdowns.

The tables turned against Mines when they lost Adams State College in Alamosa and were thumped 31-0. The Orediggers' next game was to travel to a series of six teams

**Alumnius Heads Military Science**

Colonel Jerry Higginbotham, Emeritus of Mines, '61, returned this fall after nearly 20 years to head the Military Science Department at CSM. After graduating in January 1961, Jerry entered active duty for what was to be a two year Reserve Officer tour. He has held command and staff positions with troops at Company, Battalion and Engineer levels in addition to staff positions at U.S. Army Headquarters Europe and Heidelberg, and the Air Defense Command in Colorado Springs. In 1965, he received a Master of Engineering degree in Military Science and Engineering. As Professor and Acting Director of the Military Science Department at CSM, he has held command and staff positions with troops at Company, Battalion and Engineer levels. He has held command and staff positions with troops at Company, Battalion and Engineer levels. He has held command and staff positions with troops at Company, Battalion and Engineer levels.

For further information contact Coach Jack Hancock, (303) 279-0300 ext. 2374.

**Auscus Hydraulic Clutch**

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Oil Shale: Its Production, Properties and Utilization

OIL SHALE RESEARCH—Taking one step closer to the goal of utilizing the oil shale resources of Colorado, Phillips Petroleum Company recently donated $36,150.00 to the Colorado School of Mines. The donation was made for research in oil shale for the academic year of 1980-81. A portion of this will be spent on graduate research studies on “Liquid Products from Steam Pyrolysis of Shale Oil” under the direction of Dr. V.G. Yesavage and Dr. P.F. Dickson. The balance is provided for undergraduate research on “Nitrogen and Arsenic Removal from Oil Shale”. These are two of the most important impurities found in oil shale. The project will be under the direction of Dr. J. G. T. Alles. (To right, are Dr. William Molesky, CSM vice-president for academic affairs and dean of faculty; George M. Paulson, Jr., Phillips Petroleum attorney; and CA. Wentz, Phillips’ manager of oil shale technology on the part of the short course participants.)

The course lectures will also focus on the differences between commercial, semicommercial and research stage processes. Analytical methods and alternative methods for the use of oil shale and water law will also be covered.

The course will consist of intensive lectures and discussions from Monday through Wednesday, with classes from 8:30 a.m. to 5:00 p.m. The registration fee of $475 includes course tuition, text materials and extensive comparison of the production processes, from economic, environmental and technological viewpoints.

The course lecturers will also focus on the potential methods of production, beginning with a discussion of the ground and in situ. There will also be an extensive comparison of the production processes, from economic, environmental and technological viewpoints.

The figures were compiled by Tom Johnson, chief mining engineer with Snowmass Coal Company of Carbondale, Colorado and Robert Reeder, associate professor of mining engineering at CSM. Reeder is also director of the Mine Health and Safety Institute at Mines.

Based on suggestions from mine safety directors, Johnson and Reeder sent a questionnaire to 26 coal companies. A total of 20 completed the questionnaire in time—of those, 13 submitted the report. A cost: 13 underground and 8 surface coal mines. The questionnaire focused on six areas:

1. Cost of training
2. Cost of accidents
3. Cost of inspections
4. Cost of agreements
5. General costs incurred by safety department
6. Cost of new safety equipment and machinery modifications.

Complete with tables of the data, the report concludes that accidents reduction should receive the major thrust of the coal companies’ attention. An example by cutting accidents in half, a mine producing 1 million tons per year could save up to $1 million to $1, according to the report. The publication also includes the questionnaire used in the study. Single copies of Mineral & Energy Resources are $2.50.

According to a recent study published by Colorado School of Mines Press, the annual safety cost for a underground coal mine is $2.73 per ton, while the cost for surface mines is $1.15 per ton.
Mineral & Energy Resources Review

According to the July edition of Mineral & Energy Resources "Oil Sands: Resource, Recovery and Industry," the oil sands of Alberta, Canada and Utah could make a significant contribution to solving our energy problems. Oil sand, tar sand, bituminous sandstone, oil-imregnated sandstone or bituminous sand has been identified in almost every country in the world and in almost every state in the United States. Alberta reserves are estimated at 1,000 billion barrels, while the United States has an estimated reserve of 30 billion barrels─29.5 of it in Utah.

An overview of oil sand industry, "Oil Sands: Resource, Recovery and Industry," was written by two project engineers in the Energy Division of the Colorado School of Mines Research Institute─Mr. Christopher H. Cox and Dr. Gary L. Baughman. To date, only the oil sands of Alberta have yielded synthetic liquid fuels on a commercial scale, according to Cox and Baughman. Ironically, the Alberta oil sands support the only commercial synthetic fuel plants in the world, yet U.S. energy policy places little emphasis on development of this resource.

Coal Research Institute (CRI) at the Colorado School of Mines, a new initiative in coal research has been announced. CRI is being established to become a research and educational facility. Funding for CRI will come from the government, industry, and private sources. The first goal of CRI is to conduct coal research on the coal bed, coal formation, and coal mining techniques.

The CRI will be located in the newly constructed Regents Hall, a facility that will be opened in the fall of 1981. The facility will include laboratories, offices, and a research library.

Education Assistance

Dames & Moore

Energy and Mineral Economies Planning
Mining Engineering and Geology
Rock Engineering for Open Pit and Underground Mines
Design of Tailings Disposal Systems
Ground and Surface Water Hydrology
Meteorological Investigations
Air and Water Quality Studies
Foundation Engineering
Permitting and Environmental Investigations

Arco Check

DONATION—(Randi) Remachem deterrent, (Arco) process engineer for the Arco Coal Company, gives a $1,000 check to Dr. William Copeland, head of the metallurgy department at the Colorado School of Mines. The donation is part of the Arco program of assistance to higher education. At right is Dr. William Musser, vice-president of academic affairs and dean of faculty at CSM.

Small Mine Symposium

The First International Symposium on Small Mines Economics and Expansion will be held in Taxco, Guerrero, Mexico, from May 17 through May 21, 1981. Sponsoring the editors of World Mining and World Coal, it was originally scheduled to be held in Queretaro.

In addition to technical sessions on various aspects of mining technology and economics, delegates will have the opportunity to tour the Taxco lead-zinc-silver mine of Industrial Mexican Mining Company, Speakers from over 13 different countries will present papers at these sessions. The mainstay of the industry in many countries today is the smaller tonnage operation—mines that process less than 10,000 tons of ore per day. The symposium will address operating problems and economical considerations for starting up and expanding mines in this size range.

For details and registration information contact Cecily A. Collins, Symposium Assistant, World Mining/World Coal, 2000 Howard St., San Francisco, CA 94105.
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- **Copper Refinery**:
  - Amarillo, Texas

- **Lead Refineries**:
  - Glover, Missouri
  - Omaha, Nebraska

- **Zinc Refinery**:
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- **Cadmium and Indium Plant**:
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