

A DYNAMIC FORCE THAT INITIATES MOTION TO A BODY OR SYSTEM

IMPULSE

SUMMER 1993



SOUTH DAKOTA STATE UNIVERSITY
COLLEGE OF ENGINEERING, BROOKINGS



Dear Alumni:

This IMPULSE illustrates the wide variety of innovative talent we have in our citizens, faculty, students and alumni. You will find an amazing array of interests, capabilities and new ideas in this issue.

In addition to the stories in this issue, I would like to report that the College of Engineering is pursuing funding and support for a number of proposed programs: a Ph.D. program concentrating on water resources and environmental concerns in the Upper Midwest Region; a ground source heat pump research laboratory and training site unique to the upper midwest; and a construction-oriented technology program which would provide properly trained people for our state and regional construction industry.

Our student population in Engineering, Mathematics, Physics, Computer Science and Technology is 1,161 undergraduates and 242 graduate students.

We are also continuing to pursue funding for additional space for the teaching and research laboratories as well as department offices. The College of Engineering Dean's Advisory Council is taking an active role in supporting this need. We will be calling on you in the near future to consider any assistance and counsel you can provide as we finalize our plans and firm up our needs.

It is an exciting time to be associated with a college which is vital to economic development in the region in providing technical talent, engineering assistance, research and many other services as our students and faculty interact with new and existing industry.

Be sure to stop for a visit when you are in the area. Interaction with our alumni and friends is vital to our plans for serving students and the public.

Sincerely yours,
Duane E. Sander, P.E., Ph.D.
Dean of Engineering

IMPULSE

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ABOUT THE COVER:

Engineering student Matt Lacey of Dell Rapids maneuvers a safe descent down the stairs by Crothers Engineering Hall and around the campus green in the Mini-Baja dune buggy designed and built by a team of SDSU engineering students. The idea began in April 1992 and culminated June 4 in Dayton, Ohio, at the Midwest Mini-Baja Competition.

IMPULSE

is published twice each year by the Office of University Relations and the College of Engineering, South Dakota State University, Brookings, S.D. 57007

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Communications Center
Brookings S.D. 57007
605/688-6161

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Mini-Baja Racing Team

The newest vehicle in Brookings didn't roll off the assembly line in Detroit or Japan. It was created by 13 mechanical engineering students at South Dakota State University.

The SDSU Mini-Baja Racing Team created a small, dune buggy-like vehicle for the Midwest Mini-Baja Competition June 4 in Marysville, Ohio. The team planned to compete in six events: the hill climb, maneuverability course, tractor pull, acceleration/top speed/braking, static design judging and a three-hour endurance race.

Overall team leader was Matt Lacey of Dell Rapids. Teams were: Finance: Joannah Abels of Wilmington, Del., Julie Hoffman of Aberdeen, Shaine Weelborg of Bryant and team leader Mark Skinner of Elk Point. Frame and Body: Steve Emter of Flandreau, Lacey and team leader Jeff Skelton of Hazel.

Transmission and Drive Train: Todd Riecke of Bismarck, N.D., Vosberg and team leader Ken Gray of Elk Point.

Steering, Braking and Suspension: Kevin Kleinsasser of Hitchcock, Nick Miu of Brookings and team leader Shawn Warkenthien of Willow Lake.

The group's advisers were Kurt Bassett, assistant professor of mechanical engineering, and Steve Turner, instructor of mechanical engineering.

Students create vehicle for Midwest contest

The idea to compete in the race began in April 1992. Jean Vosberg of Westbrook, Minn., and other mechanical



Shawn Warkenthien, Ken Gray and Matt Lacey discuss the drive train and other aspects of the baja vehicle while they assemble the car, designed and built by a team of SDSU engineering students..

engineering students went to Rapid City for a conference where the South Dakota School of Mines and Technology had a mini-baja.

"We really got excited about doing it ourselves and talked about it all the way back to Brookings," Vosberg said. "When the fall came, it was listed as a design project and 13 people joined the group."

The group was divided into four teams so each team could concentrate on a different aspect of the project.

"Usually, we've done industrial projects for senior design class because they're practical and useful," Bassett said. "When they proposed this project, we looked at it to see if it would do the same things the other projects do as far as learning and motivation. We decided it would be appropriate, primarily because they had to build something within the framework of the contest."

One of the biggest concerns for the project was to get enough financing to build the car. The goal was to get donations of parts and money to fund the project." Skinner said. "We also attained Student Oriented

Research and Design status from the College of Engineering, which allowed us to use funds alumni donate for research projects."

Skinner's team computed a cost report for the competition which included the estimated cost of 4,000 units on the production line. The cost for the manufacturer would be \$1,550 with a retail price of \$3,900.

While funding was being obtained, each team worked on designing its



Members of the baja racing team: Kneeling: Nick Miu, Shaine Weelborg, Julie Hoffman, Jeff Skelton, Shawn Warkenthien, Ken Gray. Standing: Todd Riecke, Matt Lacey, Joannah Abels, Steve Emtter, Jean Vosberg, Mark Skinner. Not pictured: Kevin Kleinsasser.

portion of the vehicle. "Even though it was designed on paper, not everything works out as it is planned," Skinner said. "We learned from our mistakes and made things better on the vehicle."

"The project has been really good in helping us start with the concept of what we wanted, then we redesigned and rebuilt it because the first idea didn't really work," Lacey said. "Finally, we got a prototype which could compete in Dayton."

Lacey said the competition is set up to be very similar to what a professional design team would have to do. "Steve Turner, one of our advisers, was hired by Cessna to do a contract for the government," Lacey said. "We found out that what he had to do wasn't much different than our project. He was given certain criteria to meet and he had to do it. We did the same thing, only on a much smaller scale."

"It was really important to communicate with the other groups to

bring it all together," Vosberg said. "If you don't communicate, you're going to end up with something that doesn't work."

"The hardest thing was to get everything done in the amount of time we had," Warkenthien said. "I had 13 credits plus I spent 15 hours a week on the vehicle. It really took a lot of time, but we could have spent even more time on it."

"It was hard to get motivated about the mini-baja when you couldn't see it," Lacey said. "But when we actually started working on it, we got motivated again. It was especially satisfying at Engineering Exploration Days, when we had it displayed and people came to talk to us."

Bassett said students really began to understand the realities of designing throughout this project. "They learned how to obtain and integrate components and adapt them into the system," he

Several important contributors made it possible for the SDSU Mini-Baja Team to compete.

Briggs and Stratton of Milwaukee, Wisc. (Founded by SDSU alumni Stephen Briggs and Charles Coughlin) Eight-horsepower engine.

Polaris Industries of Roseau, Minn. Shock absorbers, rear axle and swing-arm assembly, rims, drive clutch, transmission, drive belt and chain, tie rods, A-arms, strut assembly, front and rear wheel hubs, brake assembly and sprockets.

Hayes Industrial Brake Co. of Mequon, Wisc. Master cylinder, calipers and brake pads.

W.W. Tire Service, Inc. of Bryant Front and rear tires.

Car Quest of Brookings Steering wheel and tachometer.

Sport Wheels Inc. of Jordan, Minn. Brake rotor and linkages.

Northern Border Pipeline of Brookings, monetary contribution.

Lacey Well Drilling of Dell Rapids, monetary contribution

Wink's Jewelry of Brookings, monetary contribution

Chevy Lounge of Brookings, monetary contribution.

Kurt Bassett of Volga, monetary contribution.

Daktronics of Brookings, monetary contribution.

Porter's Bait Farm of Brookings Assisted with clutching and cost information for Polaris parts.

Wal-Mart of Brookings Gas can.

said. "With the vehicle, even though it's not a passenger car, they found out in a hurry that it's pretty complex because they have to worry not only about performance, but safety."

"We've learned more working on this than in classes because it gives us a chance to call companies who are

Mini-Baja Racing Team

working on similar designs," Gray said. "It's a hands-on experience, so you can actually work on components rather than just study them."

Because the group was successful in completing a vehicle for competition, Lacey said other students are interested in continuing the project next year. He said the frame can be used for up to five years, so the students can decide to keep it or redesign it.

"As soon as we let other students see the vehicle, it will spark interest from mechanical engineers," Lacey said. "A lot of underclassmen have stopped team members in the halls and asked about the project."

"Our ultimate goal was to get something done this year that students could work on next year," Warkenthien said. "Hopefully we made it a lot easier for them."

"The students have seen the classroom learning come together in something real," Bassett said. "They've really worked hard to get it ready to drive in a little over one semester. Whether or not they did well at the competition, the benefits of the project were excellent."

Baja Team places tenth overall

Even though it was the first time out for the South Dakota State University Mini-Baja Racing Team, they -- and their vehicle -- performed extremely well at the Midwest Mini-Baja Competition in Marysville, Ohio, June 4.

Of 74 entries, the team ranked 10th overall. The group ranked third in maneuverability, 10th in endurance and, in the design portion, received a perfect score in ergonomics which is operator comfort and environment. Although the team placed 40th in acceleration, it had one of the highest top speeds.

Team members who travelled to Marysville were Shawn Warkenthien, Ken Gray, Jean Vosberg and Matt Lacey. Mechanical Engineering graduate students Jim Lund and Gary Minor accompanied the team as advisers.

The endurance race provided some interesting moments for the whole group.

Gray was the first driver in the race. When he was approaching the first jump, the driver in front of him locked his brakes and slid sideways.

"He caught my tire, so I went over the jump sideways and landed sideways," Gray said. "When I landed, I broke the bead in the rear tire. We pushed it off the track to fix it. Later, a car rolled into the pit area and broke a woman's arm, so there was a red flag. During the red flag, we fixed the vehicle."

Warkenthien drove the second leg of the race and had a relatively smooth ride. Lacey was the last driver.

"When I came down a hill, I passed someone and caught his tire," Lacey said. "I rolled end over end three times, then landed. I looked around and everything was okay, so I kept going and finished the race."

"It was an excellent experience and a fun ride," Gray said. "It's something that really has to be experienced. I hope it continues next year."

Inventors Congress

enters second year

For the second year, inventors from throughout the region had the opportunity to participate in the South Dakota Inventors Congress held at SDSU April 22 and 23 as part of Engineering Exploration Days.

The winner of the Jack Hoffman award for the most marketable invention was Willard Meyer of Meyer Distributing in Huron. Meyer's invention was a wind runner coupling which allows a travel-trailer or fifth-wheel to tilt from side to side, not just forward and back.

"It allows the pickup truck and camper to operate individually and takes the pressure off both units," Meyer said. "It makes the camper easier to hook up and eliminates fishtailing."

Meyer distributes the product himself and has it manufactured at Specialty Industries in Bath. He also has several distributors in South Dakota and in Arizona.

He said the recognition from receiving the first place award has helped his business. "It helps us in advertising and we'll use it there," Meyer said. "You really need to advertise and it gets expensive, so the money will be used for that."

The winner of the People's Choice Award was Harold Fratzke of Cottonwood, Minn., who won the Jack

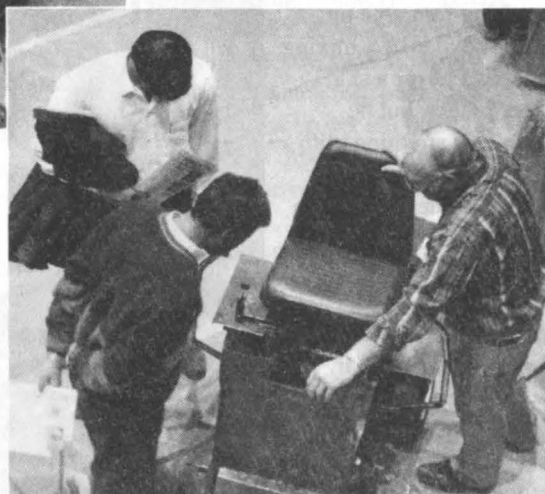
Hoffman Award at last year's Inventor's Congress. This year, Fratzke entered the Tiny Toter, an attachment that carries children at the side of a bicycle. The Tiny Toter functions independently from the bicycle if a tipover occurs.

"I like to go biking with my grandchildren, but I don't like to carry the kids behind me where I can't see them," Fratzke said. "My daughter-in-law tipped over with a child in a back carrier and got hurt. With the child on the side, I enjoy it much more."

Everyone who has tried the Tiny Toter has nothing but praise for it, Fratzke said. He is awaiting word from a manufacturer about distributing it nationwide.

Fratzke said he is using the money he won at the Inventors Congress to pay for brochures to advertise his product.

For more information, call the SDSU College of Engineering, (605) 688-4161.



Pictured from the top: Troy Suhr shows how his Pit Stop invention works; students give Raymond Rutten's Jam-N-Hoop a workout; Harold Fratzke shows off his Tiny Toter; Merlin Hanson explains his belt adaptation for a lawn mower.

Other Inventors Congress winners were:

- Floyd Reed of the F.W. Reed Company in Rochford: the Appearance, Presentation and Quality of Display Award (\$50) for the Extra Space, an attachment to the back window of a pickup to create storage space.
- Bill Horn of Rapid City: Safety Award (\$50) for his Magnetic Socket Holder.

Awards in other categories were:

- Sporting Goods: First: Mark Ekern of Flandreau for the Tag Along Caddy. Second: Raymond Rutten of R + R Enterprises in Osakis, Minn., for the Jam-N-Hoop.
- Agricultural: First: F. B. Recker of Dyersville, Iowa, for the Hole Maker, which creates hole in square bale to eliminate mold. Second: Merlin Hanson of Nunda for a belt adaptation for a lawn mower.
- Tools: First: Bill Horn of Rapid City for the Magnetic Socket Holder. Second: Dean Libra of Canton for the Snow Scoop.
- Automotive: First: Mark Reed of Durkin-Reed Inc. in Pierre for the Frost Buster. Second: F.W. Reed Co. Inc. of Rochford for the Extra Space.
- Miscellaneous: First: Harold Fratzke for the Tiny Toter. Second: Mark Ekern of Flandreau for the Super Cooler.

SkidMix

Ag engineering project shows strong manufacturing possibility

Selecting the right project for a senior design class is very important. This year's agricultural engineering students definitely got it right.

Members of the design team created the SkidMix, a multi-purpose mixer to use as a skid steer attachment. The design won first place in the design contest of Engineering Exploration Days and is entered in a regional

American Society of Agricultural Engineers contest with a possibility of being in the national competition later this summer.

Team members are Darren Fehr of West Bend, Iowa, Tim Murray of Blue Earth, Minn., Lance Minor of Brookings, Darin Schriever of Hurley and Mike Monnens of Brookings.

Schriever spent last summer as an intern with DuAI Manufacturing, an agricultural equipment and metal fabrication company in Sioux Falls.

"An engineer I was working for came up with the idea of a mixing attachment for a skid steer loader, but he didn't do anything with it," Schriever said. "In the fall, when we had to come up with ideas for the project, I remembered that idea. I called him and he said we could work on it."

Group advisor Ralph Alcock said DuAI is looking very seriously at the product for commercial production with possible markets in construction, landscaping, rental yards and agriculture. DuAI

has chosen some potential buyers to test the SkidMix and report back to them.

But getting from an idea to a useable product wasn't easy. "Once we narrowed down what the mixer was going to do, we developed drawings and sent them to DuAI to see if they could make parts," Fehr said. "They said they would

concrete would move in it because most of us don't know that much about concrete," Schriever said.

"A lot of common sense had to be applied," Fehr said. "For our project, we had to think how the operator might use this wrong, so we had to look at several safety factors. It was a matter of determining how the operator thinks."

"It's not every time you have a design class that has a product with commercial potential," Alcock said.

"What's really good about it is the students work as a group and

learn to interact with each other. Each person had strengths in different areas, so they all had different aspects each could concentrate on."

"Everybody did a good job pooling ideas," Fehr said. "Everyone is pleased with our design and the potential it really has."

Other student winners in the Engineering Exploration Days design contest were: second (\$200): Darin Franklin of Volga, Marti Pohl of

Rosholt, Brian Miller of Pierre, Becky Downing of Ivanhoe, Minn., and Mark Glissman of Brookings for a storm door/window testing apparatus; third (\$100): Matt Keck of Rapid City, Reed McKee of Brookings and Kerri Nitzschke of Sioux City, Iowa, for the Sprint Car Wing Redesign.

Demonstration contest winners were: first (\$500): Vince Krog of Miller for his Nondestructive Analysis; second (\$200): Corey Plender of Orange City, Iowa, and Adam Aberle of Sioux Falls for their Image Processing Techniques.

"It's not every time you have a design class that has a product with commercial potential," Alcock said.

"Everybody did a good job pooling ideas"

make the rough structure if they could have it when it was built."

"We went down to Sioux Falls to see if anything like it was already being built," Schriever said. "We also looked at other mixers and their designs so we could come up with our own design."

The students had to decide what would happen in the mixer — how big the paddles would be, at what angle they would be bent, how many there should be. "It was tough to think about how the



Darren Fehr explains the SkidMix, a multi-purpose mixer used as a skid steer attachment, to a group of students during Engineering Exploration Days.

Graduate student

invents color machine vision

Human hands must separate green and black potato chips from the golden brown chips in a manufacturing plant. But now, with a device perfected by SDSU graduate student Eric Moser, the chips can be separated by machine.

The key is Moser's new "color" vision machine, which gets rid of the bad chips by identifying colors and shapes.

Machine vision is used world wide in many different applications, but currently use only black and white pictures.

Moser, working with Dr. Stephen Schiller, assistant professor of physics at SDSU, found a way to make the machines work with color video cameras to allow recognition of objects based on color alone.

"The machines in use today are shape dependent, for when it searches for a pattern it can only recognize an object by a shape that the system has been trained to identify," Schiller said.

Moser's system will allow companies like Green Giant to detect snakes in their green beans and decide whether an ear of corn should be whole kernel or cream style.

The vision machine that Moser modified as a color machine was a Cognex 3400, valued at \$30,000 and made by the Cognex Corporation in Needham, Mass. It was donated to SDSU through Luther Hegland, a College of Engineering alumnus. Hegland presented a colloquium at the SDSU College of Engineering in December 1991. Schiller and Moser were in the audience and, during Hegland's presentation, got the idea of using the Cognex 3400 to produce a color vision system. They approached Hegland with the idea.

"You allow us to use one of the machines and we will try to come up with a color vision system," Schiller suggested. Hegland sent the machine within a few months.

Moser defines machine vision as the use of devices for optical sensing to

automatically receive and interpret an image of a real scene in order to obtain and/or control machines or processes.

The Cognex 3400 is currently used around the world in many pattern recognition applications. The Cognex algorithm is performed on only gray scale images and is highly shape dependent.

"To understand what changes needed



Eric Moser, graduate student, and Dr. Stephen J. Schiller, professor of physics, work in the image processing laboratory with Moser's color vision machine system.

to be made, we had to understand the optics of color," Moser said. "In any optical system there are three different areas of importance: the illuminator, the reflectors and the detector. Each of these has its own characteristics which influences the observed color.

"Before the Cognex system was donated to SDSU, I made some preliminary experiments to test the feasibility of adapting color to machine vision. I used a black and white CCD camera with the astronomical blue, green and red filters in front of the lens. These filters will only pass certain wavelengths to the camera. They were not exactly the same wavelengths as the RGB standard,

but I felt were close enough for a preliminary test. I used a circuit board with yellow and blue capacitors as my object, a PC with a frame grabber and my own "C" language program to capture the image and do the search. This system was not perfect, however it was enough to make me believe color machine vision could be done."

Moser's next task was to adapt the Cognex 3400 to "see" in color.

"The major obstacle was that the frame grabber accepted only black and white video signals," he said. "Also, I wanted speed to match the abilities the system has using gray scale algorithms. These two considerations led me to consider transforming as much of the digital signal using hardware as possible."

In the image processing lab, Moser used the PC computer as a front end for the Convex machine.

"The algorithm is still in its infancy," he said. "I have not included a transformation into XYZ space, the standard color signal used by the video industry, nor have I taken advantage of the speed of the Cognex's vision processing chip. These enhancements will come this summer. I will also determine the best method for thresholding the image. I think color machine vision is definitely possible and plausible. The technology is available and the applications are numerous."

Machine vision systems have been used for 20 years, serving many uses in industry, such as testing for defects in watch face plates and checking for proper alignment in computer chips. Machine vision is also used to track the serial numbers of air bags in cars.

"Machine vision tracks them to see where they were made, who they were sold to, which cars they were installed in and who purchased the cars," Moser said. "Machine vision reads the serial numbers and records this data.

"Machine vision can also check the serial numbers on nuclear waste canisters and other hazardous substances. Machine vision can go where humans can't go and read data."

Now, with Moser's system, machine vision will be able to go further and do more than ever before.

Dennis Helder, assistant professor of electrical engineering at South Dakota State University, has developed a procedure to improve the readability of satellite data, which makes life better for people on earth in a number of ways.

The EROS Data Center near Sioux Falls has been an archive for satellite imagery recorded from the earth's surface since 1972, when it began storing material from the Landsat satellite. The first

Helder

develops procedure to improve readability of satellite data

satellite in this system was the Earth Resource Technology Satellite, or Landsat I. Five of these satellites have gone up since then, because each satellite has a life span of about five years. The EROS Data Center maintains the oldest archive of satellite imagery, data that has been used in many ways over the last two decades.

The Department of Agriculture uses Landsat data to determine the number of acres planted in food crops in the United States and in foreign nations around the world.

The length and quality of Landsat's data record and the repetitive nature of the satellite's observations make it a perfect tool for monitoring environmental change, such as changes in polluted lakes. Landsat data identified the position and amount of oil in the water in Prince William Sound after an Exxon tanker crashed on a rock near Valdez, Alaska, in 1989. The super tanker spilled about 260,000 barrels of black, sticky crude oil into the water, killing fish, water fowl and other animals.

"Landsat Multispectral Scanner data has the potential for being widely used in global change studies, since it has been collected for nearly 20 years," Helder said. "This data archive represents a unique resource for early global change studies. It is crucial to the success of these studies that Multispectral Scanner data be as accurate as possible."

Since 1988 Helder has conducted research in image processing. His major goal has been to make the data more accurate radiometrically by overcoming technical problems that produce subtle stripes on the recorded images. During his dissertation work in 1989-90, Helder

discovered a way to reduce the striping in Landsat Thematic Mapper imagery.

The stripes, or exhibit degradations, appear on images obtained from multiple detectors on the satellites due to unequal detector response. The Multispectral Scanner collects data from six sensors in each spectral band, therefore it is vulnerable to degradations from unequal detector response from each sensor. A Multispectral Scanner has flown on all Landsat satellites.

Beginning with Landsat 4, a new instrument, called a Thematic Mapper, has been used. It is much improved over the Multispectral Scanner, with better resolution and radiometric accuracy. The

data is stored on a magnetic tape and can be displayed on a computer. Twenty years ago, data was stored on four 9-inch tapes. Now some tapes store 20 images.

"Remote sensing imaging follows the evolution of the computer," Helder said. "The better and more efficient the computer, the better we can store the data."

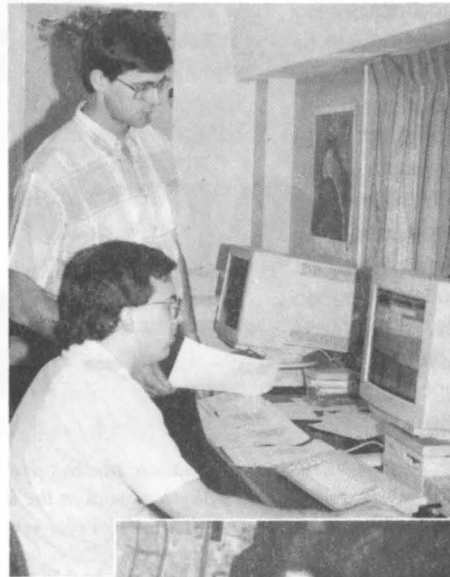
Unfortunately, radiometric calibration methods changed substantially through the years as technology advanced and better and more efficient devices were placed on satellites to collect the data. Helder's research is valuable because his findings have helped devise methods to provide more uniform calibration of the data from satellites.

In February Helder received two awards from the American Society for Photogrammetry and Remote Sensing for his paper "A Technique for the

Reduction of Banding in Landsat Thematic Mapper Images." He received the 1993 John I. Davidson President's Award for Practical Papers and the 1993 ERDAS Award for best Scientific Paper in Remote Sensing.

He recently presented a paper describing Multispectral Scanner calibration at the 1993 International Symposium and Exhibition on Optical Engineering and Photonics in Aerospace Remote Sensing in Orlando, Fla.

Helder earned bachelor's degrees in animal science in 1979 and electrical engineering in 1980 and a master's degree in electrical engineering in 1985, all from SDSU. He earned a doctorate in electrical engineering from North Dakota State University in 1991.



Dennis Helder, assistant professor of electrical engineering at SDSU, works with Brian Iwerks, an SDSU student from Welcome, Minn. Helder developed a procedure to improve the readability of satellite data. His procedure overcomes the technical problems that produce subtle stripes on recorded satellite images like the one pictured.



Researchers, alumni

create technology to help farmers



SDSU faculty have teamed up with Tim Aughenbaugh and Kent Klemme, graduates of the SDSU College of Engineering, to help farmers produce crops more efficiently. Aughenbaugh's company, Ag Info Tech in Iroquois, is creating technology to help farmers save money.

SDSU researchers Donell Froehlich, professor of mechanical engineering, Joseph Schumacher, research associate in plant science, and Daniel Humburg, assistant professor of agricultural engineering, are working with Ag Info Tech to improve agricultural practices and system economics through the state-sponsored CITE Program.

In this joint venture, the participants are applying engineering technology to help farmers produce crops more efficiently in terms of resources, time and money.

They are currently testing a computerized field management system that can be used as an aid in all phases of crop production —tillage, chemical application, planting and harvesting — for site specific farming, which is farming according to the location of quadrants within the field. Fields are divided into grids with widths that correspond to the width of production machinery.

"Field areas are identified based on a key factor," Schumacher said. "For example, some areas of the field might have high weed infestation while other areas of the field might have low weed infestation. The length of the grids are determined by the soil type, fertility or weed infestation in a particular part of

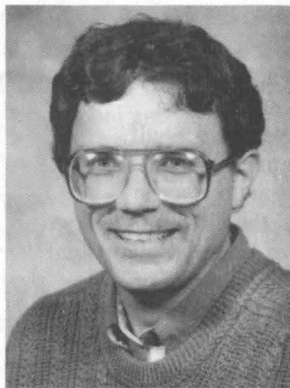
the field."

Operating farm machinery according to the needs of a specific location in the field is

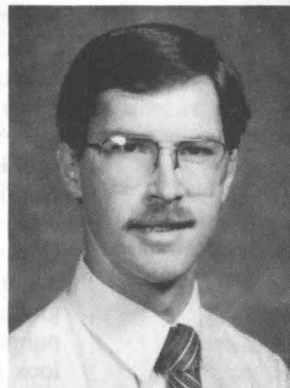
possible due to the development of microcomputers and associated hardware. Computer technology used in conjunction with soil grid mapping lets



Donell Froehlich



Joseph Schumacher



Daniel Humburg

the farmer regulate the use of his machinery. Soil grid mapping divides a field into grid regions based on soil conditions like moisture content and pH levels.

Some farmers have tabulated field information using commercial software programs and have created field maps or grids for their fields. This information can be used again and again in making field management decisions.

"Take the application of chemicals," Schumacher said. "We can apply a pesticide at a variable rate and record the amount applied to each location in a field. This procedure could allow for the more efficient use of chemicals, providing improved economic and environmental controls."

Crop harvesting is yet another use for site specific technology.

"In harvesting, we are interested in two things: the total yield of the crop and recording the position in the field for the yield," Froehlich said. "The harvest is affected by soil type, amount and type of fertilizer and field location. Farmers have been wanting a means for recording this information.

"Consequently, a yield mapping system, (FGS Harvester System) was designed, installed on a

combine and evaluated under laboratory and field conditions. The system was created for the production of yield maps which would later be used as a site specific crop management tool. The

system also collects data for creating grain moisture maps and topography maps."

.....By using site specific technology in applications such as harvesting and field preparations, Schumacher said, a farmer can compile a data base of site specific field information for use in crop management

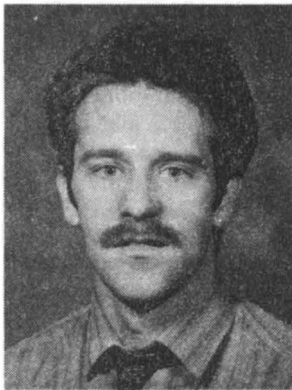
decisions. The development of site specific technologies may soon allow farmers and producers to use their computers and electronic systems inside and outside their homes for both management and field equipment operations. Froehlich said the systems will be reasonably affordable.

Also involved in the project are Greg Carlson, Dave Clay and other SDSU plant scientists, Ag Info Tech personnel and graduate students Rod Fischer, mechanical engineering, Stan Nielson, computer science, and John Dolman, plant science.

"It is hoped that the synergistic uniting of university and industry will yield a bountiful harvest for many agricultural producers in the near future," Schumacher said.

Ground source heat pump

research may lead to new training facility



Research at SDSU on ground source heat pumps has come a long way in five years and could mean a new research/training facility in Brookings as early as this fall. Charles Remund, associate professor of mechanical engineering at SDSU, began his research in 1985 while working on his Ph.D. at the University of Nebraska and continued that work at SDSU beginning in 1988. Now, he said, "It's at the jumping-off point. We could have 4,000-square-feet of laboratory space up and running late this fall."

The new facility would house research and have the capacity to annually train between 100 and 150 people who install, design and service ground source heat pump systems. Training would be specialized for cold climates and would serve HVAC contractors, well drillers, utility personnel, architects and engineers from North Dakota, South Dakota, Nebraska, Iowa, Minnesota, Wisconsin, Michigan, Montana, Wyoming, Alaska and Canada.

A year and a half ago, Remund began working with electric utilities, the Governor's Office of Energy Policy and manufacturers of ground source heat pump equipment to look at establishing a ground source heat pump training and research facility at SDSU. They hoped to find available lab space they could alter to suit their needs. Remund wrote a proposal to the Department of Energy, regional utilities and the Governor's Office of Energy Policy, the latter which awarded a \$50,000 grant to work on establishing the training lab.

"That's been very helpful," Remund said. "Without that money, we probably wouldn't have been able to carry on and get where we are today."

It looks like the training facility will become a reality, but not as originally planned. Lab space was unavailable and constructing a new building on campus was not possible. But the Brookings Area Chamber of Commerce and the Brookings Economic Development Foundation are working on plans for a

new building on city property and Remund is working toward securing funding to pay lease and operating expenses.

Training at the Brookings facility would be patterned after training done at Oklahoma State, where the International Ground Source Heat Pump Association is centered. "We're trying to be an arm of IGSHPA in the northern region," Remund said.

Funding would be a cooperative effort between several sources. Many utilities have voted to contribute money and manufacturers have pledged to contribute equipment.

"We've got a lot of interest out there," Remund said. "It's a win-win situation. The University is going to gain. The utilities are going to gain. The people who put these systems in gain because it can cut their heating bills by 30 percent or more."

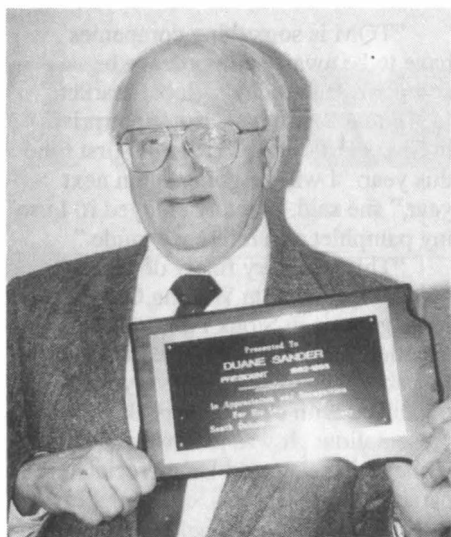
Remund received a research grant to rewrite the IGSHPA grouting manual.

"It's a win-win situation. The University is going to gain. The utilities are going to gain. The people who put these systems in gain because it can cut their heating bills by 30 percent or more."

The \$475,000 project is a cooperative effort with the University of Idaho, Oklahoma State University and two private companies. "A little more than half of the money will stay at SDSU to fund graduate students, purchase specialized equipment and support the research," Remund said.

.....Remund's current research involves two

projects. One, funded by the National Rural Electric Cooperative Association, is a study of bentonite grout for backfills for vertical buried heat exchanges. This research is focused on ground heat transfer and groundwater contamination. The project began in October 1990 and ended in December 1992. Remund has recently completed writing the final report. The second research project, funded by the Electric Power Research Institute, deals with identifying and indexing the thermal properties of different kinds of soil. This project began in July 1991 and will end this fall.



Sander

serves S.D. Engineering Society as president

Duane Sander, dean of the SDSU College of Engineering, concluded his year as president of the South Dakota Engineering Society in April. It was a year of working to strengthen involvement with the Legislature and connections with engineering groups throughout the state. "During this year we concentrated on legislative issues and developing ties with other engineering professional organizations in the state," Sander said. "The Society has become a very viable representative of professional engineers in South Dakota."

Working with schools is another, ongoing focus of the South Dakota Engineering Society. Through its "One on One" program, the Society offers assistance to K-12 teachers in a variety of ways. On request, they connect volunteer engineers with teachers needing assistance. The Society arranges for classroom demonstrations, tours of various industries and assistance with technical subjects.

"It gives the teachers another resource to use in their teaching programs," Sander said. "There have been some interesting things done."

Serving as a viable resource to schools is a goal of the Engineering Society at both the national and state levels.

"We have an excellent, ongoing MATHCOUNTS program," Sander said. "It's one of the very important programs within the national society, as well as the state."

Sander credits much of the Society's success to executive director Raye Jeanne Fallbeck, who he said is responsible for increasing membership and improving the finances of the Society. Fallbeck, in turn, said Sander was an outstanding president.

"What I really appreciate about him is that he is a quiet, gentle, wonderful individual who really gets things done," she said. "He never tries to grab the spotlight. He's a good example to engineering students. People want to work with him and follow his lead. And he's generous with his resources. He always looks to see if he can provide a resource that is needed."

Before serving as president, Sander was vice president and president elect of the Society. He was officially named president during the Society's annual state conference Rapid City in April 1992. He's been a Society member since 1970.

Sander was born in Sioux Falls and graduated from Howard High School. He earned a bachelor of science degree in electrical engineering from the South Dakota School of Mines & Technology in Rapid City in 1960 and a master of science and Ph.D., both in electrical engineering/bioengineering, in 1962 and 1964, respectively, from Iowa State University in Ames.

From 1960 to 1962 Sander taught undergraduate courses in electrical engineering at Iowa State University. From 1965 to 1966 he was an intelligence analyst for the U.S. Army Foreign Science and Technology Center in Washington, D.C.

Sander joined SDSU in 1967 as an associate professor of electrical engineering. He became a full professor in 1975 and director of engineering extension and development in 1984. He was named head of the Department of General Engineering in 1985, acting dean in 1987 and dean in 1990.

A registered professional engineer in the state of South Dakota, Sander is a senior member of the Institute of

Electrical and Electronic Engineers (IEEE), whose Siouxland Section named him Outstanding Electrical Engineer in 1988. He is a member of Sigma Xi, Sigma Tau, Phi Kappa Phi and the National Society of Professional Engineering.

Sander was listed in Outstanding Educators in America in 1974 and Who's Who in Technology in 1981.

Engineers go 'One on One,' thanks to state Society

Raye Jeanne Fallbeck has done much for the South Dakota Engineering Society during the four years she's been executive director.

The past year, through Fallbeck's guidance, the Society has had a six percent membership increase — three times the national Society's goals. Also, Fallbeck's establishment of a newsletter, funded by advertisements, has helped stabilize the Society's finances.

"She's really been the person who's turned the Society around," said Duane Sander, dean of the SDSU College of Engineering and Society president last year. "She's developed a newsletter that I think is the envy of the nation and has secured the advertising dollars to fund it. And she's really helped sensitize us to the need to be more attuned to legislative affairs and how they affect the engineering profession."

"We (the Society) work harder and work smarter to accomplish more with less," Fallbeck said. This has helped the programs and the people of the Society to become well known in their fields.

Fallbeck started the "One on One" program, which is part of the plan provided by the National Science Foundation Systematic Initiative. South Dakota was one of 10 recipients of this five-year, \$7.5 million grant.

One on One provides every South Dakota K-12 school with an engineer who acts as a consultant to teachers. The program bridges the gap that teachers may experience between the theories they read in books and the application of those theories. As a result, both teachers and students are becoming more involved with math and science.

The state Society, which is affiliated with the national Society, promotes ethics, professionalism and professional registration.

The South Dakota Engineering Society is made up of four chapters: Northeast, Southeast, Central and Black Hills. Each has its own structure and are the heart and soul of the organization.

TQM Symposium

marks record participation, continued success

For the third time, the Total Quality Management Symposium, held in Sioux Falls March 11 and 12, marked a record attendance and continued success.

Participation increased from 50 the first year to 150 last year to 240 this

year. And a survey of participants recorded high marks all around, from cost to advanced registration to quality of speakers.

"Everything ranked very high in the evaluations," said LaDell Swiden, director of the University/Industry Technology Service, which sponsors the

symposium. "Overall, respondents said they enjoyed the speakers' commitment and enthusiasm and were impressed by how the



The third Total Quality Management Symposium marked a record attendance with 240 participants, who ranked the speakers, content and organization of the symposium as excellent.



speakers could relate at all levels.

"The symposium included quite a broad range of national and local speakers and was presented locally for industry, business and government. Attendees included a broad range of people from small companies to large, from state government to education, which shows the broad interest in TQM. Hutchinson Technology sent 25; Daktronics sent 9; Toshiba of Mitchell sent 4.

"TQM is something companies have to be aware of in order to be competitive in today's global market."

Paula Bak from Orion Enterprises in Sioux Falls attended for the first time this year. "I will be going again next year," she said. "I really enjoyed it. I use my pamphlet as a reference guide."

"This was very finely done," said Merle Plucker from Walling Chemical Management in Sioux Falls. "They had excellent preparation before the event. In a short synopsis, it was very well organized with excellent speakers and presentations. It was well worth the money." Plucker said he appreciated the cafeteria-style lectures, enabling him to select speakers who would benefit him most.

The first day of the symposium, four concurrent tracks were offered on management, manufacturing, education and tools and techniques. The second day, participants chose workshops on ISO compliance, SPC and situational leadership and team building.

Featured symposium speakers were Fred Winkler, executive vice president of customer services for AT&T's Universal Card Corporation; Wayne Fortun, president and chief operating officer of Hutchinson Technology Inc.; and Dr. Robert Lacher, professor of mathematics and statistics at SDSU.

A new aspect to the TQM Symposium this year was a segment on Partnering — "an area where UITS can assist the construction industry," Swiden said.

To provide follow-up

reinforcement to the information provided at the TQM Symposium, four live satellite teleconferences were held at several locations throughout eastern South Dakota in March, April and May. These concluded with a May 17 telecast featuring Dr. W. Edwards Deming, a world-wide management expert who won several honors for his work in Japan, creating new principles of administration and revolutionizing production.

"TQM is something companies have to be aware of in order to be competitive in today's global market."

T3S

budget increases to meet growing needs in technology transfer service

Centers like T3S were formed because local governments throughout the country were lacking both in high technology experience and sufficient funds. Therefore, in 1981, Congress created the Rural Technology Assistance Program

In 1988, the first-year budget for the South Dakota Transportation Technology Transfer Service was \$135,000. This year, the T3S budget is \$239,000, indicative of its growing needs.

Dr. Ali Selim, professor of civil engineering and T3S director, said that though the federal allotment increased by \$18,000, the center has sought funding from other sources to meet their increasing work load.

Of the \$239,000, the federal government provides \$118,000; local government highway and bridge funds provide \$91,000 (Established through a Legislative bill several years ago, the money comes from vehicle registration fees.); SDSU and the South Dakota School of Mines and Technology donate \$7,000; the Department of Transportation provides \$14,000; carry-over from last year is \$9,000.

Selim said the success of T3S is due to the support of these agencies, as well as SDSU and the College of Engineering.

"We are probably one of the best technology transfer centers in the country and our success is attributed to the DOT," Selim said. "They help us a great deal. They have helped us expand,

especially in the training area. They supply most of the training for us.

"Another reason for our success is strong support of the various local government agencies in the state of South Dakota. They are the ones who endorsed our resolution to acquire state funding. These agencies include the Association of County Commissioners, the Association of Highway Superintendents, the Municipal League and the South Dakota Engineering Society. All of these organizations are behind us 100 percent. They support us in the Legislature and for funding."

Centers like T3S were formed because local governments throughout the country were lacking both in high technology experience and sufficient funds. Therefore, in 1981, Congress created the Rural Technology Assistance Program, which was later renamed the Local Technology Assistance Program

to accommodate both rural and urban areas. There are now 51 centers throughout the nation, one in each of the 50 states and one in Puerto Rico.

Before T3S was formed, there was only one person in the DOT to answer questions — and he was incredibly busy, Selim said. "There is such a great need for an organization like ours. Before we established the technology transfer center, local governments really suffered a great deal because they had nobody to turn to."

Technology transfer centers act as a focal point for all local governments and municipalities up to 1 million population. "In South Dakota, that means every town and city," Selim said. "They contact us to get all the information they need free of charge. We provide the technology assistance."

T3S is one of the five complementary research and/or technology transfer programs that make up the Engineering and Environmental Research Center, which was established in 1986 to serve the University, citizens and industry in South Dakota.

T3S has several programs to disseminate information:

- Training programs. T3S offers about 50 free workshops throughout the state on such topics as maintaining gravel roads, inspecting bridges, designing asphalt roads and winter snow maintenance. Workshop instructors are DOT personnel as well as consultants hired by T3S.
- Road show. A van equipped with videotapes, TV, VCR and printed materials goes to local governments, offering many one- to two-hour workshops on such topics as signing, cold recycling of gravel roads and maintenance of low volume roads. "We answer all their questions in their back yard, so to speak," Selim said. "We go to them and help combat some of the problems they face in their roads and bridges."
- Quarterly newsletter. Most articles are written by T3S staff and address local problems or experiences, like a new method of inspecting a bridge or paving a road. The newsletter is mailed in-state and out, including to each of the other 50 centers. Selim said the newsletter generates many calls and much positive feedback.
- Toll-free, nationwide phone number. Technical questions on all subjects are answered. "We get a lot of phone calls every day with technical questions," Selim said. "We try to respond on the phone right away or send them the information they need."
- Videotape library. More than 250 videotapes deal with planning and administration, safety issues, fixing potholes, equipment maintenance and more. They are loaned free of charge two weeks at a time to local governments.
- Printed material library. T3S offers more than 200 volumes of publications covering a variety of issues and subjects, like management, safety, maintenance, inspection, tort liability, etc.
- Various activities. T3S staff, for example, develops software which is available at no cost to help local governments do their job more efficiently. T3S staff also develops manuals, like the highway superintendent certification, signing manual, etc. T3S also produces videos. Three videotapes were produced for distribution to clientele addressing cold recycling, pulverizing machine and shouldering techniques. Other videos are planned for future production.

Water resources

Tracy conducts research for Northern Great Plains Water Resources Research Center

An important goal of the late Gov. George Mickelson was to guarantee South Dakotans continued access to adequate, quality water supplies.

Mickelson's legacy is ensured by the formation of the Northern Great Plains Water Resources Center, which he helped establish.

John Tracy, assistant professor of civil engineering and assistant research professor of the Northern Great Plains Water Resources Research Center, has been empowered to conduct and coordinate water research, provide information and help strengthen water resources for South Dakota and surrounding states. Hired in fall 1992, Tracy said he is especially concerned about water pollution and contamination.

"At present, the complex nature and interaction of contaminants, soil and water is poorly understood, hindering remediation efforts," Tracy said. "Water pollution involves the degradation of water quality in terms of biological, chemical or physical criteria. The extent of water degradation is generally determined on the basis of its intended use."

Tracy said a number of substances cause pollution of surface and ground water, including organic matter, heavy metals, organic and inorganic chemicals and radioactive materials. These pollutants are generated by agri-business, industrial entities and governmental bodies, as well as individuals. They can be introduced into surface and ground water accidentally, through improper disposal or misuse, causing serious contamination problems and possible long-term abandonment of vital water resources.

"Complicating the picture is the fact that we are just beginning to discover how

toxic some chemicals can be," Tracy said. "Some products in common use 10 years ago are classified as critical contaminants today. Substantial research is needed to develop best management practices for agriculture and chemigation, proper watershed management and the reduction of non-point pollution from agriculture."

Tracy, a top authority in water resource engineering, has written numerous documents and made many presentations on water resource management. He presented a report recently in Seattle, Wash., on "Basin Scale Management of Surface and Ground Water" and at the International Ground Water Modeling

"Water pollution involves the degradation of water quality in terms of biological, chemical or physical criteria. The extent of water degradation is generally determined on the basis of its intended use."

Center in Denver, Colo.

"An adequate supply of good quality water is critically important to South Dakota and the Northern Great Plains Region for agriculture, industrial development and human consumption," Tracy said. "There are two sources of water: ground water and surface water."

Surface water is seen in lakes and streams. But about 85 percent of all water in the continental United States is stored underground in aquifers. About half of our population depends solely on ground water for its water supply.

Continued advances in detection instruments have allowed better monitoring of pollutants. But economical ways have not yet been found to reduce or remove several types of pollutants from soil, surface and ground water sources.

"Research is needed to develop response mechanisms to chemical spills, to determine aquifer sensitivity to

chemical attack and to understand the transport behavior of these chemicals through soil, both experimentally and through modeling efforts," Tracy said.

Tracy earned a bachelor's degree in civil engineering at Colorado State University in 1980. He received a master's degree in 1986 and a doctorate in 1989 in civil engineering through the Water Resources Engineering Program at the University of California at Davis.

Before coming to SDSU, Tracy was assistant professor of civil engineering at Kansas State University in Manhattan, a research assistant for the Department of Land, Air and Water Resources at the University of California at Davis and a hydraulic engineer at the U.S. Army Corps of Engineers Hydrologic Engineering Center in Davis, Calif.

His research interests have been in the areas of water movement and the fate of contaminants in a subsurface environment; statistical analysis of surface and subsurface hydrology; and management and control of water use.

Tracy is a member of the American Geophysical Union, the American Society of Civil Engineers, the American Water Resources Association, the Air and Waste Management Association, the National Society of Professional Engineers and Chi Epsilon honor society.

He received the Outstanding Research Orientated Journal Paper Award by the Journal of Irrigation and Drainage Engineering, ASCE in 1989; the Chi Epsilon Teaching Excellence Award in 1991 at Kansas State University; and was a finalist in the College of Engineering Hollis Award for Excellence in Undergraduate Teaching at Kansas State in 1992.

His project "Optimal Control of Well Pumpage for Short-term Mitigation of Contaminated Ground Water Supplies" is funded through April 1994 by the State Water Resources Institute Projects, Grants and Groundwater Research and Public Education Program.

His project "Modeling of the Use of Plants in Remediation of Soil and Groundwater Contaminated by Hazardous Organic Substances" is funded through May 1994 by the U.S. Environmental Protection Agency Hazardous Substances Research Center.

Tracy

combines engineering and ice dancing

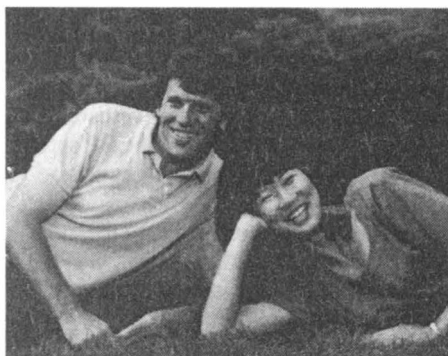
John Tracy, assistant professor of civil engineering, and his wife Denise have been looking at the engineering aspects of competitive ice dancing, proving that engineering principles can also be applied to leisure time activities.

The couple started taking classes in ice skating through the Sacramento recreation program while John was working on his doctorate in civil engineering at the University of California in Davis. Denise earned a bachelor's degree in computer science from the University of California.

John and Denise combined their knowledge of engineering and computer science to find more effective ways to compete in ice dancing.

The Tracys came to SDSU in fall 1992 when John accepted his current position as well as assistant research professor for the Northern Great Plains Water Resources Research Center.

At the SDSU College of Engineering, Denise took a course in statics, which deals with the analysis of stationary



bodies. The course is a prerequisite to a course in dynamics, which deals with the study of the relationship between motion and the forces affecting motion — the study of bodies in motion.

"This course will help her understand kinesiology, which deals with the study of muscles and their movement as applied to physical conditioning," John said. "Physical flexibility, strength, timing and rhythm are used in dance. So the study of dynamics will help her understand how the human body can become more effective while dancing.

"We had a very good ice skating coach in California who knew how to teach first-time adult students. He learned how to skate when he was in his 20s, so he knew the problems and strengths of the older student."

After their first course, the Tracys signed up for two years of skating lessons. At the University of Northern Illinois, Denise takes dance classes that stress

technique and body movement.

John says his wife is a good athlete and has always worked hard to excel in sports.

"She played basketball and tennis through high school and college and was more an athlete than an artist," he said. "Now she is taking dance, which is an art. Her dance teacher also started late as a dancer and did not mind taking on an adult student with a late background in dancing."

After graduating from dance, Denise may go into dance therapy to help both mind and body relax. Or she may decide to teach dance.

"No matter what she decides to do, with her dance instruction, she will receive a lot of personal satisfaction by improving her performance as an ice dancer," John said.

The U.S. Olympic team has studied body types in terms of weight distribution and set up equations to help athletes win at swimming, track and field and a variety of sports events. They have worked with engineers and other professionals and taken a multi-disciplinary approach. The Tracys plan to follow a similar program on a smaller scale.

After Denise returns to SDSU and completes the dynamics course, the couple will set up a computer program to help them improve their performance in ice dancing.

Microelectronics and Materials Laboratory

holds grand opening celebration April 23

The College of Engineering showed the public the innovative new equipment in the Microelectronics and Materials Laboratory in Solberg Hall during its grand opening April 23. Engineering Dean Duane Sander called the 1,200-square-foot clean, dust-free workspace a "unique facility" in the Upper Midwest.

Laboratory coordinator Lewis Brown said the lab space is used for analysis of electrical properties of materials, design and characterization of sensor devices and hybrid electric packaging.

"About 20 graduate and undergraduate students are now using the MML facilities for both education and research," Brown said. "Currently we have outside-funded research which was made possible only by the analytical resources of the MML and the research expertise of our College of Engineering faculty and the Governor's Office of Economic Development."

This summer research will be done on a new polymer sensor material. Sensor applications which can be designed from ferroelectric polymer research and development include medical

ultrasound imaging to aid diagnostic study of human tissue for cases involving burns, skin grafts and skin cancer; passive infrared sensors that detect heat and motion which are used in airport security and burglar intrusion alarm systems; and hail-detection sensors for farm equipment.

Equipment for the MML was provided by SDSU alumni, the South Dakota Governor's Office for Economic Development and Elf Atochem Sensors, Inc. of Pennsylvania where Brown used to work.

Donations benefit MML

The College of Engineering has received significant equipment donations for the Microelectronics and Materials Laboratory from two sources in the past year and a half.

Dr. Errol P. EerNisse (BSEE '62) of Quartztronics in Salt Lake City, Utah, donated microelectronics fabrication equipment worth more than \$10,000.

Atochem Sensors Inc. of Valley Forge, Penn., donated more than \$28,500 in equipment for the testing and analysis of ferroelectric polymer materials and sensor devices.

CRP acres

mapping team to help protect groundwater

A grant, matched with funds from SDSU and the University of South Dakota, is supporting research that will map the exact location of CRP acres in Lake County and help protect the groundwater.

The three investigators for the project, entitled "Geographical Information Systems as a Tool for Developing Groundwater Management in High Risk Areas," are Janet Gritzner, associate research professor at the Engineering and Environmental Research Center, SDSU, Dr. Diane Rickerl, associate professor at the Plant Science Department, SDSU, and Ralph Davis, assistant professor at the Earth Sciences

Unit located mainly in Lake County.

"Groundwater and preserving water quality is a real priority in high government circles," Gritzner said. "We know that there is agricultural pollution of water. We don't feel our area is strongly affected, but it could be. And we want to prevent it."

The research team will study the relationships among agricultural practices, wetlands and the aquifer itself, monitoring wells and instrumenting wetlands to see if they are recharging the aquifer and if contaminants are moving from one to another.

The ultimate goal is to rate the degree of risk to water quality and to put together appropriate management for risk areas. When CRP land comes off the program, the research team wants to be able to make management recommendations that will be environmentally sound and economically feasible.

"These lands are going to come out soon, probably in 1996," Gritzner said. "There should be some recommendations on how to avoid the potential problems when they come out."

One possibility is to enroll the land in a long-term government program sponsored by the USDA or Game, Fish and Parks, Gritzner said. GF&P, for example, may be interested in land highly-populated with pheasants. Rickerl added that USDA programs such as the Wetland Reserve Program and/or the Water Quality Incentive Program may offer viable solutions.

"There's a lot of interest in knowing the location of CRP lands and wetlands and adjacent land that wildlife likes," Gritzner said. "We see this as more than a wetlands project. We see the project as having multiple uses in the end."

Nationwide, there are 35 million acres of CRP land. In South Dakota, there are 2,083,602 acres of CRP land on 12,135 farms. The exact location of CRP land has never been digitized so that it can be combined with other data, Gritzner said.

But the research team is finding plenty of information to go on. When farmers enrolled their land in the CRP program, they had to document such things as erodibility status according to the Soil Conservation Service, evidence of flooding and tillage histories. "So there is a lot of good information to be used for a research project," Gritzner said.

Department, USD.

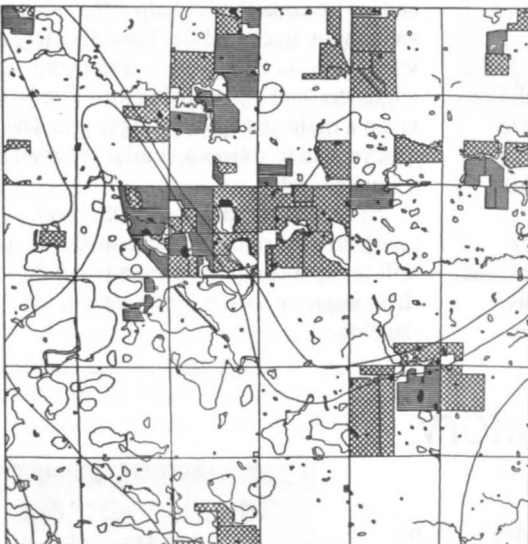
Total project cost is \$105,068. The state Department of Environment and Natural Resources Groundwater Research and Public Education Program (GRPEP) is funding \$58,688; the rest (\$46,380) is coming from matching funds from various sources at SDSU and USD.

The two-year effort began May 1 this year and will end April 30, 1995. Gritzner said it is one of the most recent of many projects funded through GRPEP. And, she said, it will probably be one of the last because the program, which began in 1989, will soon end.

The project has two components: Geographical Information Systems (GIS) and a strong field component. Gritzner is providing the GIS expertise for the project. She said they will

combine many different kinds of maps and manipulate them in different ways for analysis. The field component will be coordinated by Rickerl and Davis, along with Tom Machacek, a field scientist hired through GRPEP as a research associate at SDSU.

The team will look at essentially three things: wetlands, Conservation Reserve Project lands and the location of shallow aquifers. Gritzner said they will study a portion of the Big Sioux aquifer, the northern Skunk Creek Management

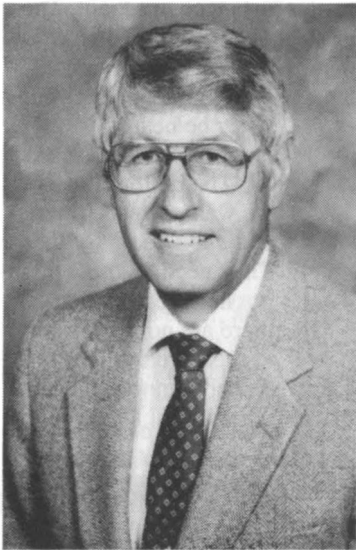


Wetlands on CRP Lands
High Erodible Lands
Non High Erodible Lands

This map shows Brookings County with Highway 14 running through its center. On the left side, just below Highway 14, is Brush Lake. The left side of the map ends just before where you would turn to go to Arlington. The wavy lines show the boundaries of the Big Sioux Aquifer.

News briefs

Ellerbruch serves three terms on municipal utility board



Virgil Ellerbruch, head of the Electrical Engineering Department at SDSU, completed three five-year terms of service on the Brookings Municipal Utility Board in April. Board president Lynn Anderson presented Ellerbruch an engraved plaque and said his technical background and continuity have greatly benefited the board and the city. General Manager Craig Osvog credited Ellerbruch with the automation of the utility's accounting and billing functions and said Ellerbruch is motivated by what is best for the City of Brookings. Ellerbruch has been a "coach, a mentor, an encourager and someone who is not only available, but approachable," Osvog said.

O'Brien opens new field in geophysics

John O'Brien, assistant professor of physics, has explored his opportunities and opened up a new field in geophysics.

O'Brien, who has 12 years of experience in the oil exploration field of geophysics, is using oil exploration techniques to find ground water. Some of these techniques may be well suited for ground water exploration, he said, and he plans to use them to characterize sites to find ground water.

"There are many techniques that have been developed in the oil industry that look as if they would work," O'Brien said. "There is an excellent opportunity here (in ground water exploration)."

The primary technique that O'Brien has used is the seismic technique, which helps discover, from the surface, areas that may have good drilling prospects of either oil or gas. Once the wells have been drilled, it can also identify where other drilling areas may be.

O'Brien has spent many years working in the oil exploration field. He worked on the Northern Slope of Alaska, where he could only work in the winter so that the snow could protect the environment of the tundra. He also worked at sea in the Gulf of Mexico.

University/Industry Technology Service has updated the SDSU Faculty Expertise Directory. Funding for updating the directory, which is on an electronic catalog, was provided by the UITS University Centers Grant from the U.S. Department of Commerce's Economic Development Administration. Funding for printing and postage was provided by US West.

For a copy of the new SDSU Faculty Expertise Directory, write the Engineering & Environmental Research Center, Harding Hall 228, Box 2220, South Dakota State University, Brookings, S.D. 57007-0199 or call 688-4184.

The South Dakota State University College of Engineering Research and Outreach Report has been published for FY 1991-92. For a copy, write the Engineering & Environmental Research Center 228 Harding Hall 228 Box 2220 South Dakota State University, Brookings, S.D. 57007-0199 or call (605) 688-4184.

Society of Women Engineers sponsors

'Take Our Daughters to Work Day'

Fifteen little girls took a giant step into the world of engineering April 28 when the SDSU Society of Women Engineers sponsored "Take Our Daughters to Work Day."

The project, a first this year, was the brainchild of the Ms. Foundation for Women in New York City, which originally planned the day for 9- to 15-year-old girls in just the New York area. But word spread and women across the nation began making plans to take their daughters to work, too.

When she read of the project in Working Mother magazine, Madeleine Andrawis thought, "Why not us? Why not SDSU and the College of Engineering?" Andrawis, assistant professor of electrical engineering and advisor of the SDSU SWE Chapter, brought the idea to Chapter members, who agreed to sponsor "Take Our Daughters to Work Day" as an outreach project.

Andrawis organized the project with the help of Tenison Stone, a junior mechanical engineering student. "She put lot of time into this," Andrawis said. "I was glad I found somebody to back me and work with me on this. It was a good idea. It was a good experience for all the girls."

The afternoon visit began with a welcome and the handing out of some take-home souvenirs — pencils, bookmarks, wall posters and colorful folders. Then it was off on a tour. Anita Kotschegarow, spring graduate of electrical engineering, demonstrated her senior design project — two train sets controlled by microprocessors.

In the electronics lab, the girls saw Andrawis demonstrate speech patterns

and whistling frequencies on an oscilloscope and did hands-on experiments using light bulbs and DC voltage.

Mary DeVries, research scientist, showed the girls how to read satellite maps and do computer mapping. Professor Larry Browning made a little magic in the Physics Department when he sent a smoke ring across the room and cast the girls in their very own laser light show. "The kids were fascinated with that, they were changing designs

with their own hands,"

Andrawis said. "Dr. Browning is very excited about what he is doing and he got the kids excited."

In the computer lab, Jan Froehlich, instructor of general engineering, demonstrated how to draw with a computer and showed the girls cartoon slides made by Computer Aided Design.

"They were fun and the kids enjoyed them," Andrawis said. "It was a very good demonstration. It was some laughs and a good time."

The final treat of the day had the girls crossing campus to the SDSU Dairy Bar for ice cream cones, courtesy of Engineering Dean Duane Sander.

"The day was beautiful," Andrawis said. "College students were all over and the kids enjoyed seeing them. The interaction itself was a good experience for the girls."

When the girls got home that day,



they found a package from the Ms. Foundation, ordered by Andrawis. Inside was a "Take Our Daughters to Work" T-shirt and a booklet dealing with obstacles girls face in school. The booklet, "Who do you think you are?" relays the message to "Keep trying.

Don't give up. Let your voice be heard," Andrawis said.

"The bottom line is, we want to reach them and open doors for them. They need to know their possibilities and that there are no limitations to their dreams and career planning. That's what it's all about."



From top: Cara Cecil and Daniele Deibert experiment with light; Mary Andrawis watches her speech pattern on an oscilloscope; Jennifer Holen and Amy Roth enjoy ice cream cones at the SDSU Dairy Bar; Anita Kotschegarow shows the girls how to operate two train sets controlled by microprocessors.

Master's in industrial management

joins several disciplines at SDSU

"The program is really geared to middle management," Kornbaum said. "It's set up so someone in a technical environment can manage resources, finances, other personnel or the plant itself."

A police chief, an operations director and a microbiologist may not seem to be engineers, but they all received their master's degrees from the College of Engineering at South Dakota State University.

SDSU Police Chief Scott Vandall, associate director of SDSU Student Union operations Joe Regier and process and product development manager Marsha Behrens earned the Master of Science in Industrial Management (MSIM) degree.

The purpose of this program is to provide knowledge, skills, techniques and analytical tools necessary to effectively manage and understand the financial and technical aspects of a complex operation.

The program's coordinator, Frank Kornbaum, said the MSIM has specific core requirements, but after those have been met, other classes can be tailored to the student's needs. The present MSIM program started in 1984 and currently has 40 percent of its students from non-engineering backgrounds.

"The program is really geared to middle management," Kornbaum said. "It's set up so someone in a technical environment can manage resources, finances, other personnel or the plant itself."

Areas of study include quality control, materials handling, production equipment design, management leadership styles and safety. The curriculum includes classes from engineering, economics, sociology, education and counseling, math and computer science.

"I was looking for an advanced degree with coursework where I could develop my managerial and technical skills," Regier said.

"Because of my life experiences and the core work in counseling, I chose this option." Regier said the classes were very relevant to his work. "I don't think one course I took didn't relate to my job and it was astoundingly true to life," he said.

Vandall said he has a much better view of the technical side of his job since he completed the program. "It helped widen my view, not just at work, but in general," he said. "I don't think a person can ever stop learning and these courses definitely showed me that. I think I'm a much better administrator having taken that program. I feel in my mind and with my peers that I've improved in a lot of different areas."

Behrens works at Minnesota Corn Processors, a corn wet milling and ethanol plant in Marshall, Minn. Since she already had an undergraduate degree in biology and microbiology, she wanted an advanced degree that would give her business courses plus enhance her technical knowledge.

"The program is really well-rounded because it gets into a lot of areas," Behrens said. "I took safety and industrial hygiene classes as well as many other interesting classes like motivation and human relations."

"It was a challenge getting my master's because I had been out of school for 20 years, but told myself I could do it and I did," she said. "When I started, I was one of the first students involved in the MSIM. I'm glad SDSU started this program and that it's growing."

"I highly recommend this program," Vandall said. "It's one of the best graduate programs around, bar none. I can't say enough good about it."

For more information, call (605) 688-4161.

Design project benefits Yankton company

A design project done by SDSU undergraduate engineering students should result in significant cost savings for the Freeman Company of Yankton.

The company manufactures a clevis, which threads onto the ends of control rods in airplanes. The company uses a batch method to produce the rod-end clevis and is experimenting with the manufacturing cell method to reduce cost and production time.

Company president Rob Burton worked with University/Industry Technology Service at SDSU, discussing with LaDell Swiden and Steve Turner how UITS could provide him the industrial engineering applications and experience he needed.

Senior mechanical engineering students Lee Morgan and Jeff Indahl conducted the design project during the 1991-92 school year. Turner was faculty project advisor. Craig Pahl, quality engineer for 3M of Brookings, and Pat Cannon, manager of new business development for Raven Industries of Sioux Falls, served as consultants.

Through time studies and machine regroupings, the students predicted that using cellular manufacturing could result in a cost savings of 68 percent for inventory and 19 percent for parts.

Burton said he feels the Freeman Company will see significant savings when they put the system in place. "All in all, we were quite pleased with the project and UITS," he said.

Internships

and summer jobs pay off for students

While working their summer jobs, David Sutton and Chris Neuzil didn't know just how important those jobs would be. But they definitely realize it now.

Sutton of Flandreau and Neuzil of Papillion, Neb., both graduated in May and have permanent jobs where they previously worked.

Last year, when he was looking for an internship, Sutton talked to Computer Science Department head Gerald Bergum. Since Bergum had been contacted by SDSU graduate Joel Cannon about getting an intern for his newly-formed Cannon Technologies Inc., Bergum recommended Sutton.

"He called Joel on the phone and I talked to him right then," Sutton said. "One of the main reasons he hired me was because Dr. Bergum recommended me. He thinks very highly of Bergum."

"The thing that's important is when former students come back and ask departments to get students for internships, they really have a lot of respect for the education they got here at SDSU," Bergum said. "They know we have students who are well-trained and that's why they want to stay with us."

Cannon Technologies writes load control software for power co-ops and power stations. Sutton said when he started last summer, the company had just completed a new software package, so he tested it for a few weeks. He also helped answer client questions, worked on a graphic information package, shipped computers and did whatever else was needed.

"By the time I left, they said, 'Take your best offer and we'll beat it because we want you to come back,'" Sutton said. "So I could go through my senior year and know I had a job."

Neuzil didn't have an internship, but he worked for three summers with the Corps of Engineers at the Omaha District Office. He was in the construction division for two summers

and the geotechnical branch for one summer.

He said many people don't apply for federal jobs

because they have to fill out a tremendous amount of paperwork. But if you're willing to take the time to fill the forms out neatly and correctly, he said the extra effort could be worth it.

"My grades weren't the best, but employers look at other things, like experience," Neuzil said. "Before I worked for the Corps, I worked for the Soil Conservation Service and the City of Omaha Public Works Department."

It's also important, Neuzil said, to join

professional organizations to make key contacts, to remain outgoing and friendly with people and to become involved with campus activities. Because he was involved in the Joint Engineering Council and other activities, he could get references from the dean of Engineering and professors.

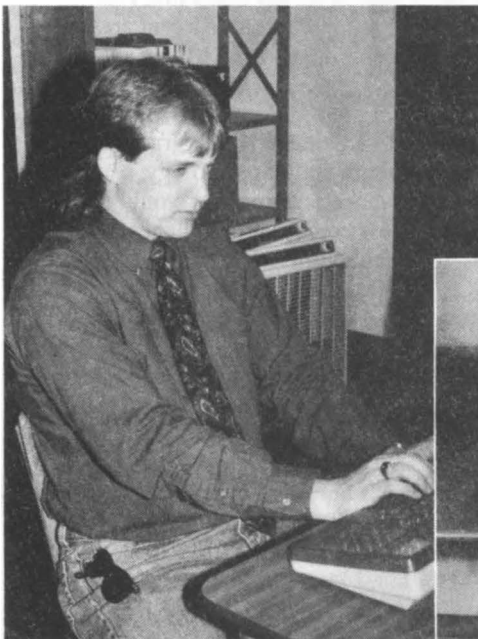
"My boss told me some things I could work on during the summer so I could make some changes and be more likely to be hired full-time," Neuzil said. "Also, because I applied for a job early, they were able to hire me permanently before a hiring freeze took place."

"My internship turned out to be very important," Sutton said. "Without the connections and experience, I

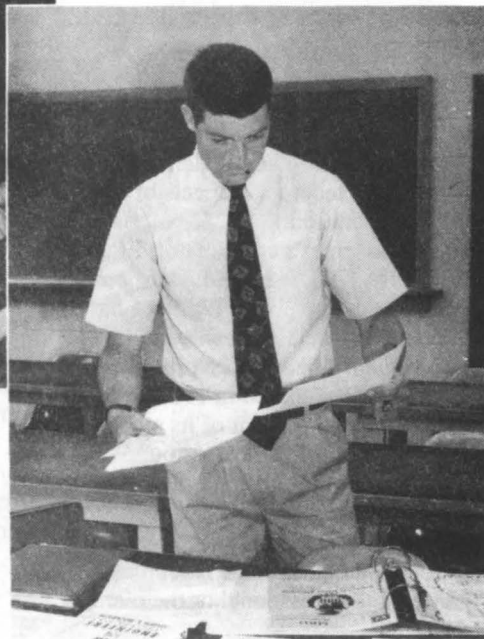
wouldn't have a job. Other places I have looked have hiring freezes or I wasn't qualified."

"It's important to keep your options open," Neuzil said. "I started my first job at only \$4 an hour, but I got my foot in the door with the federal government. If you have the incentive to go after what you want, you can do it."

"My internship turned out to be very important," Sutton said. "Without the connections and experience, I wouldn't have a job. Other places I have looked have hiring freezes or I wasn't qualified."



David Sutton of Flandreau, left, and Chris Neuzil of Papillon, Neb., know the value of internships and summer jobs. After graduating in May, both secured permanent jobs with their summer employers: Sutton at Cannon Technologies Inc. in Minneapolis and Neuzil for the Corps of Engineers in Omaha.



Internships pave the way for future jobs

Internships and cooperative work programs provide students earning power, learning power and a stronger resume to take into the job market.

Kevin Impecoven of Britton, a junior majoring in computer science, works with multi-media presentations at Extension Computer Services at SDSU. He began his job last summer and worked through the fall semester.

Through his advisor, he arranged for his job to count as an internship for the spring semester. He plans to return this fall, for what he learns on the job is a definite boost to his education.

"It's given me a more general knowledge of all the parts of the computer, the software, the hardware components and how to bring things together," Impecoven said. "It has a lot to do with education and the relation between the computer and the user. It's taught me how to give technical support over the phone and in person. I've also done some programming. It's a little bit of everything, which is good to start out with."

Darin Fast of Brookings, also a computer science major, is a user service consultant at Computing Services at SDSU. Like Impecoven, Fast performs a variety of duties, from determining capabilities and limitations of computer programs to troubleshooting software and hardware problems. Fast said his internship is beneficial to him now and in the years ahead.

"The experience I've gotten through working at Computing Services I can use in my career when I get out into the job force," Fast said.

Internships and cooperative work programs are available to students in all departments within the SDSU College of Engineering. Students recently or currently participating include:

Mechanical Engineering

Mike Fuller of Aberdeen: Daktronics Inc., Brookings.
Charles Hauck of Watertown: U.S. Army Tank & Automotive Co., Detroit, Mich.
Jeff Hess of Delhi, Minn.: Zytec, Redwood Falls, Minn.
Justin Alders of Clarks Grove, Minn.: Johnson Fishing Motors, Mankato, Minn.
Terry Ackerman of Eureka: Cooper Nuclear Power Plant NPPD, Brownville, Neb.
Corey Krantz of Titonka, Iowa: Melroe, Bismarck, N.D.
Brett Crawford of Pipestone, Minn.: Melroe, Bismarck, N.D.
Paul Scheier of Salem: SEI Associates, Boulder, Colo.
Marten Christensen of Sioux Falls: SEI Associates, Boulder, Colo.
Matt Okerman of Sleepy Eye, Minn.: 3M, Brookings.
Scott Yukel of Brookings: 3M, Brookings.
David DeSmet of Cottonwood, Minn.: 3M, Brookings.
Steve Schallenkamp of Sioux Falls: Raven Industries, Sioux Falls.
Kristi Podzimek of Armour: Corps of Engineers, Fort Randall, S.D.
Ken Gray of Elk Point: Prince Manufacturing Corp., Sioux City, Iowa.
Mike Hubbard of Brookings: Hub City, Brookings.
Xiang Ding of Brookings: ADVANCE, Brookings.
Ted Merdan of Bloomington, Minn.: NCR-NPD, Roseville, Minn.
Mike Fuller of Aberdeen: Falcon Plastics, Brookings.
Ron Nordhues of Brookings: Falcon Plastics, Brookings.
Dan Hansen of Dell Rapids: Falcon Plastics, Brookings.
Jerome Rudie of Belgrade, Minn.: Toshiba, Mitchell.
Brian Mundt of Agar: Rockwell International, Cedar Rapids, Iowa.
Jerry Nohl of Morris, Minn.: Superior Equipment Company, Morris, Minn.
Lonnie Rohloff of Morris, Minn.: Superior Equipment Company, Morris, Minn.

Electrical Engineering

Brant Mathiason of Brookings: Daktronics Inc., Brookings.
Dale Dean Meyer of Brookings: 3M, Brookings.
James Allen Morrison of Brookings: Daktronics Inc., Brookings.

Physics

Mike Stoops of LeMars, Iowa: Zytec Corporation, Redwood Falls, Minn.
Adam Aberle of Sioux Falls: Optical Guidance Group at the Army Missile Command, Huntsville, Ala.
Terry Ackerman of Eureka: Nebraska Public Power.

Ag Engineering

James Reedy of Brookings: the Department of Environment and Natural Resources through the Soil Conservation Service, Brookings. Reedy worked on finding solutions for high cost construction of ag waste systems and finding alternative designs.

Computer Science

Christopher Bronk of Brookings: Daktronics Inc., Brookings. Bronk worked with scheduling.
Tricia Gillen of Jasper, Minn.: EROS Data Center near Sioux Falls and the Computing Center, SDSU.
Tonya Thompson of Brookings: Daktronics Inc., Brookings. Thompson worked in the areas of personnel, records and programming.
Andrew Carter of Brookings: Chemistry Department stock room, SDSU.
Jason Ladwig of Big Stone City: Extension Computing Services, SDSU.

General Engineering

David Cole of Sioux Falls: KJJQ/KKQQ radio station, Brookings.
Bryan Wipf of Brookings: Customer Service, Daktronics Inc., Brookings.
Brian Kinstad of Marshall, Minn.: Daktronics Inc., Brookings.
Tim Paulson of Tabor: Daktronics Inc., Brookings.
Jeff Pederson of Centerville: Daktronics Inc., Brookings.
Michael Phelps of Redwood Falls, Minn.: Daktronics Inc., Brookings.
Jason Weishaar of Aberdeen: Daktronics Inc., Brookings.
Richard Gunderman of Fulda, Minn.: Daktronics Inc., Brookings.
Joel Fuhr of White Lake: Daktronics Inc., Brookings.
Brent Prusa of Vermillion: Daktronics Inc., Brookings.
Lee Schwartzrock of Brookings: Daktronics Inc., Brookings.
Jeff Iversen of Brookings: Daktronics Inc., Brookings.
Jared Kocer of Dante: Daktronics Inc., Brookings.

Mathematics

David Sutton of Flandreau: Cannon Technologies Inc., Minneapolis, Minn.
Gretchen Luttmann King of Alcester: Biogenetics, Brookings.

STUDENTS

ENGINEERING EXPLORATION DAYS

YOUR FOUNDATION FOR SUCCESS

something for everyone

Hundreds of high school and college students as well as people from around the region came to South Dakota State University April 22 and 23 for Engineering Exploration Days and the South Dakota Inventors Congress.

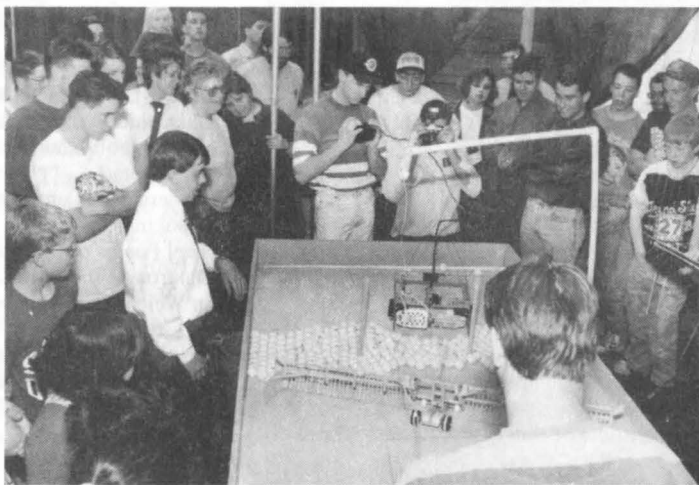
This was the first year the events for EED and the Inventors Congress were held in the same place, Frost Arena. High school students were treated to a magic show featuring the wonders of science by Dr. Larry Browning, assistant physics professor. They also participated in bridge building, the pentathlon, spontaneous questions, paper airplane and calculator contests.

Many senior engineering students participated in the design and demonstration contests (see related story) while other students took part in the Harvester, LEGO Man, pentathlon and jumper contests.

All who attended saw the wide variety of inventions from an adjustable basketball hoop to a hole maker for bales (see related story).

This was the first year a high school inventors category was included. The winner was Troy Suhr, a senior from Rutland, who was a part of the Odyssey of the Mind team which qualified for the national competition in Baltimore.

Other activities that day were the opening of the Microelectronics and Materials Laboratory, the Dean's Advisory Council meeting and the Distinguished Engineers Banquet.



A variety of fun and educational games and contests keep students busy at Engineering Exploration Days at SDSU April 22 and 24. An example of the activities offered at EED this year, clockwise from top two photos: paper airplane contest; balance the scale competition; LEGO Man; and the Harvester contest.

SDSU Civil Engineering

team wins Midwestern Bridge-Building Contest

What spans only 20 feet, can hold a 2,500-pound load and is constructed within nine minutes and 20 seconds? It's the winning steel bridge designed by students from the South Dakota State University American Society of Civil Engineers.

This 12-member group captured first place after winning the American Institute Steel Construction Bridge Building Contest Feb. 19 in Fargo, N.D.

"Having observed their work effort, and the time, effort and energy the team put into the project, I'm not surprised they won," said Chuck Tiltrum, ASCE student faculty adviser and SDSU engineering associate professor. "It's satisfying to see that they did win and were rewarded for the hard work."

The contest was held in conjunction with the ASCE Midwestern Regional Conference. SDSU competed against seven schools for the bridge-building trophy: North Dakota State University, the University of Iowa, Iowa State University, the University of Wisconsin, the University of Minnesota and the University of Manitoba.

The contest consisted of several "mini" tests. Categories included speed, bridge weight, sag test, efficiency (weight of bridge versus the sag), aesthetics and economy (weight of bridge, speed and how much the materials cost). The team winning the most categories is awarded the first-place trophy.

Contestants were required to build on site a structure spanning 20 feet. None of the bridge's steel members (such as irons, tubes, angle irons or brackets) could be more than five feet long.

After construction, judges placed a 2,500-pound load on the bridge and measured its sag. SDSU's bridge only sagged one-half inch. Their bridge not only won the sag test, but also the

efficiency and aesthetics tests.

"Putting it all together, we came out on top," Tiltrum said.

Tiltrum said ASCE's goal was to construct a light bridge using a minimal amount of bolts and connections so that it could be built quickly. However, the finished bridge also needs to withstand a 2,500-pound weight with only the slightest sag, he said.

Although only six team members were allowed to construct the bridge in Fargo, the structure was actually designed by 12 civil engineering students.

"It's like a race car. You only have one driver, but you need a pit crew to win," Tiltrum said.

SDSU's 12-member ASCE team began designing its bridge last fall, headed by Joe Duncan of Ivanhoe, Minn., and Jeff Kortan of Tabor. The design was first tested on the computer and then built using materials donated by Eggers Steel Corporation in Sioux Falls.

"It's like a race car. You only have one driver, but you need a pit crew to win,"
Tiltrum said.

The ASCE civil engineering members included: Brad Sudbeck of Dimock, Keith Carruthers of Chester, John Ladson of Spearfish, Greg Rothschadl of Tyndall, Chris Neuzil of

Papillion, Neb., Ray Pierson of Ethan, Noel Schulz of Lake Preston, Pete Longman of Willmar, Minn., Scott Vander Meulen of Sioux Falls, Eric Prunty of Tabor and

Joe Honner of Tabor. The bridge-building contest allows students to take theoretical design and apply it to small-scale practical field problems, Tiltrum said. However, he believes the contest teaches a much more important lesson.

"Teamwork, working together with people. A lot of students don't understand that until after the contest, but we can't function in the real world as individuals. Teamwork gets the final results," he said.



The SDSU Civil Engineering team that built the award-winning bridge in the American Institute of Steel Construction Student Bridge Building Contest in Fargo, N.D., in February, left to right: Keith Carruthers, Joe Duncan, Chris Neuzil, John Ladson, Greg Rothschadl and Brad Sudbeck.

Balloon project

to take research to new heights



A new project promises to take research to new heights next spring for students at South Dakota State University and the South Dakota School of Mines and Technology.

A balloon project, sponsored by the South Dakota Space Grant Consortium, will be a cooperative venture between the two universities. Students will plan, design and build experiments that will be carried by the high-altitude zero-pressure unmanned scientific balloon. They will learn about and participate in the instrumentation, launch, tracking and recovery of the balloon.

Projected launch date is March or April 1994, during the time of the turn-around winds. All design work will be completed during the fall 1993 semester, equipment and hardware will be purchased by Dec. 31 and the flight package will be assembled and tested during the spring 1994 semester.

Mechanical engineering instructor Steve Turner, project coordinator for SDSU, said that the first-year focus will be on learning to launch, recover and control the balloon. Students will study weather patterns and atmospheric effects, predict the flight profile, design the structure of the payload and design the telemetry and data acquisition packages.

Experiments the first year will involve transmitting video images from an on-board camera and student-designed communications equipment. In future years, students may study ozone or radiation levels in the atmosphere.

The two university groups will communicate through the state interactive video network. Even students not previously involved will be invited to attend the network meetings to be part of discussions on project design.

One project goal is for students to experience working with space-related systems; many aspects of the balloon project also apply to satellite

One project goal is for students to experience working with space-related systems; many aspects of the balloon project also apply to satellite technologies.

technologies. Another goal is for students to write, present and publish research papers about the project. Turner

also anticipates that students will come away with a better idea of teamwork and a sense of accomplishment.

....."It's going to be a good project," Turner said. "Different class levels and various disciplines will all be working together. I think the interaction between the two schools will be good, too. Students and faculty will both benefit. It creates unity and helps us to get to know each other. It creates a common ground."

Plans are to conduct one-day flights, launching the balloon from Rapid City in the morning and recovering it in eastern South Dakota in the evening. A radio transmitter will keep track of the balloon's location.

"Ideally, we'll launch in the morning from the strato bowl, a natural depression in the Hills that was famous in the 30's," Turner said. "So it would be a rather historical perspective to launch from there."

The project is patterned after a similar project handled by the Utah Consortium. The Space Grant Consortium hopes the project will enhance the aerospace expertise of university students in South Dakota and increase interest in science among K-12 students.

The Space Grant Consortium, which consists of the EROS Data Center, SDSU and SDSMT, is providing funds for some of the equipment and supplies. Raven Industries of Sioux Falls is donating the balloon and expertise in launching and support. Funding and assistance is also being provided by the South Dakota Future Fund and NASA.

Tim Lachenmeier of Raven Industries is project advisor. Four graduate students, two each at SDSU and SDSMT, will serve as project leaders. The balloon project is open to all students who wish to participate. For more information, call (605) 688-4184.

Engineering student

and others lose homes in storm

You always think it's going to happen to someone else until it happens to you.

Several Brookings residents lost their homes, trailer houses, apartments, cars and other possessions as a result of a violent storm that passed through the city May 7.

One of those people is Drew Schellpeper, a mechanical engineering major from Fairmont, Minn. Drew and his roommate, Laird Raschke, a park management major from North Mankato, Minn., were in their third-floor apartment at Countryside Estates in northeast Brookings when the storm hit.

"We went looking outside when we saw the wind getting strong," Laird said. "Then Drew's boat started spinning and the wind got extreme from the west."

"I yelled, 'This isn't just wind, it's a tornado,'" Drew said, "then we both dove into the closet."

"The next time we opened our eyes, the roof was gone and so was everything else," Laird said.

Even though the National Weather Service said the damage was caused by



This is the kind of damage seen by SDSU students Drew Schellpeper and Laird Raschke after the May 7 storm

126-mile-per-hour straight winds, Drew said he still believes it was a tornado.

"A straight wind doesn't pick up a boat and make it spin," he said. "It sounded like a freight train. It was so loud,

you couldn't hear the roof come off."

That night the two stayed at Laird's uncle's home in White, but they said they didn't get any sleep.

"Any noise I heard, I thought was a tornado coming," Drew said. "It really stays in your mind."

The next morning, Laird and Drew surveyed the damage. Both Drew's Ford Aerostar and Laird's Ford pickup were damaged. The roof which was previously on the third-floor apartment was top-down on the grass with Laird's ceiling fan still attached to it.

"You see that scrambled mess out there?" Laird said, pointing to the roof and other debris. "That's what's going through my brain."

Other areas of town that sustained heavy damage were Western Estates, a trailer park near Edgebrook Golf Course and Heritage Estates, an apartment complex near Brookings High School. However, no one was seriously injured during the storm.

"Everyone out here was willing to help anyone and make sure they were okay," Drew said. "I'm just thankful no one got hurt."

Student engineers learn more than engineering

Engineering is more than numbers, dimensions and designs. Communication and people skills are also very important, but often are not emphasized in the regular classroom experience.

To help remedy this, the Institute of Electrical and Electronics Engineers (IEEE) Student Chapter at South Dakota State University sponsored a Student Professional Awareness Conference (SPAC) April 27.

Chapter president Jayme Huber, a senior electrical engineering major from Freeman, said, "I think it's good experience for student engineers to get exposed to non-technical subjects outside the classroom. The speakers discussed continuing education for engineers, getting involved with business activities and communication. I don't think that's talked about enough in class."

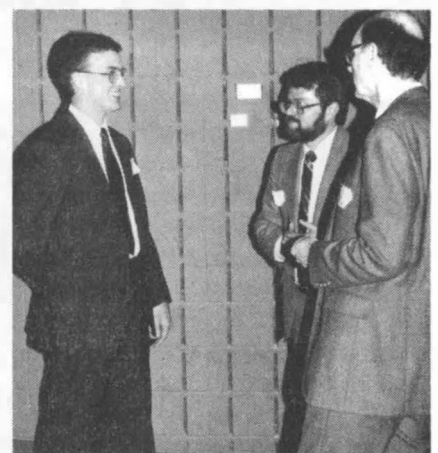
One of the speakers, Orin Laney, has worked as a design engineer and has founded several small businesses in the electronics field.

"Employers value you not just for your engineering classwork, but for your traits gratuitous to engineering," Laney

said. "Communication skills like writing, talking and conversing with customers are very important. The liberal arts curriculum you are required to take can be valuable."

He said good engineers need to read industry magazines and talk to sales representatives to see what's going on in the market right now. By doing that, students will be striving to go beyond the ordinary and average.

The conference was funded by the National IEEE SPAC Committee. Over 80 people attended the training sessions.



IEEE student chapter president Jayme Huber visits with SPAC speakers Orin Lacey, center, of Avacado Computer Video, and Philip Swain of Purdue.

Robyn Pierce

Anyone who thinks women don't know much about cars has never talked to Robyn Pierce.

As a 14-year-old, Pierce asked her dad if she could build a car. After making the initial drawings, she and her sister, Brenda, were ready to hunt for

when a project, such as my car, arises, it is not whether

"My parents, relatives and friends have always believed in me. Therefore, when a project, such as my car, arises, it is not whether or not it will work, but how well it will work."

Mechanical engineering student builds car as a teenager

parts. After two years, the car was up and running.

Pierce, a junior mechanical engineering student from Plainview, Minn., said putting the car together was an excellent experience.

"You learn that things take time, you've got to be patient," she said. "We learned it's better to get other views before you start on something. We got advice from Dad and Grandpa."

Since Pierce's dad and mom, Robert and Jonette Pierce, own Pierce Sales and Service, a small

or not it will work, but how well it will work.

I believe it makes a great difference knowing that others believe in what you're doing."

Of the four girls and one boy in the family, all but one were interested in machines.

The car Robyn and Brenda created is like a two-seated dune buggy. Most of the parts came from their dad's shop, but he basically only helped with the welding and let the girls use their own ideas to make the vehicle work.

"Right now, we generally only run it through parades," Pierce said.

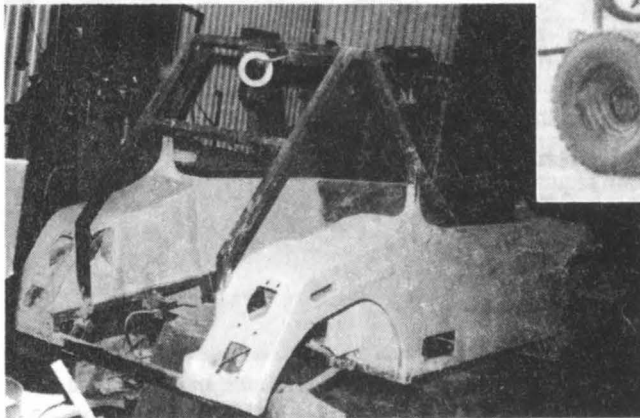
"Although it is licensed in Minnesota, I

have a few modifications I want to do before I take it a great distance."

She said she has talked to other students at SDSU who haven't had the opportunity to work as extensively on machines as she has.

"Here in college we work on book stuff. Back home, I get hands-on experience. I have more of an idea of what happens in reality," Pierce said. "You can't gain experience in a book. Experience is when you actually see it happen. It's a lot different than just reading about it."

When Robyn graduates in fall '95, she would like to design cars or work in a similar area of mechanical engineering.



engine repair and machine shop, and her grandpa had been actively involved in car bodywork, interest in cars was in her blood.

"I worked in Mom and Dad's shop since I was little and I always liked it. Dad didn't make us help him, we just did it if we enjoyed it," she said.

"My parents, relatives and friends have always believed in me. Therefore,

Robyn Pierce, a junior mechanical engineering student at SDSU, built and designed this car with her sister, Brenda. Her grandfather, Lyndon (shown in top photo) and her father, Robert, shared their advise and experience.

Daktronics

SDSU alums involved in Olympics

South Dakota State University will be represented at the 1994 Winter Olympics in Lillehammer, Norway — not by former SDSU athletes, but by former SDSU students who now work for Daktronics in Brookings.

Daktronics was awarded a \$3 million contract by the Lillehammer Olympic Organizing Committee (LOOC) to create 24-foot by 59-foot scoreboards for the five largest venues: biathlon, cross country, ski jumping, men's downhill skiing and women's alpine skiing. Since the opening and closing ceremonies will be held in the ski jumping area, the Daktronics scoreboards will be used for those events, too.

Project manager Seth Hansen, MSEE '86, helped with the proposal and presentation to LOOC. "Al Kurtenbach (Daktronics president) and I made a trip to Lillehammer to visit with the technical organization in the summer of 1990," Hansen said. "We told them we were interested in working with them to find solutions to their scoreboard needs."

In 1991 Daktronics received a request for scoreboard proposals for the Winter Olympics, but they were written in Norwegian. After installation supervisor Gary Gregg and SDSU professor Carl Sunde translated the instructions, Daktronics submitted a proposal and received a contract in January 1992.

From June to December 1992, Gregg lived in Norway to supervise installation of the scoreboards with Norwegian subcontractors and to conduct the final data hookup and testing. When each of the scoreboards arrived in Lillehammer, a Daktronics employee came with it to help set it up.

"Many years ago, I lived in Norway for a year and a half. I learned the language then and found out I have relatives there," Gregg said. "Working with the language again was very

interesting."

Gregg, his son Karl and other Daktronics employees stayed in a three-bedroom house provided by LOOC. SDSU graduates involved in the project are Hansen, Tony Kuck BSEE '89, Reece Kurtenbach BSEE '87, Dan Bierschbach BSEE '87, Scott Larsen BS Speech '88, Mike Hight BSEE '91, Steve Top BSEE '86, Troy Erickson BSME '91, Lane Munson BSEET '91, Pat Pfeifer BSEET '90 and Joe Schulte BSEE '87.

After everything was set up, World Cup events in several winter sports took place so the equipment could be tested. Hansen said the test was successful; all of the equipment worked very well.

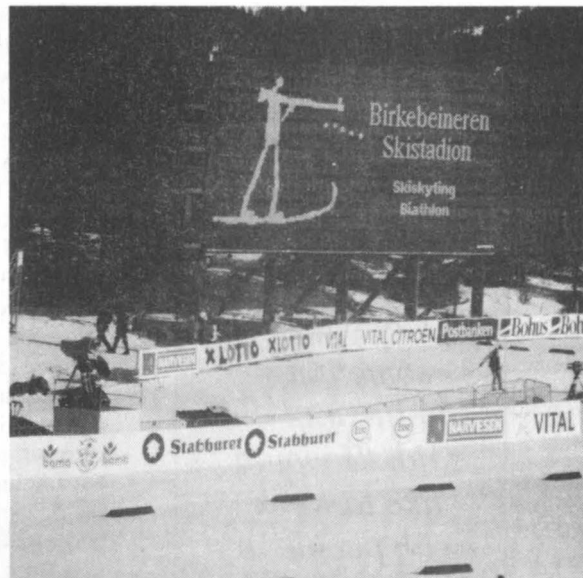
"There's a lot of excitement here at

Right: One of the scoreboards designed by Daktronics Inc. of Brookings for the 1994 Winter Olympics in Lillehammer, Norway. Below: In Norway, representatives of Daktronics Inc. pose by another of their scoreboards. (Engineering Dean Duane Sander is second from the left.)

Daktronics," Hansen said. "Not everyone can say it's part of their job to be involved with the Olympics. As a company, it gives us more credibility and helps us in other areas of our markets as well."

"Because of the Norwegian heritage for a lot of people in South Dakota, it probably gives a little extra edge to the excitement," Gregg said. "We can go back to the country of our ancestors with a tremendous system."

This summer Haakon Wiig, a representative from LOOC, will come to Daktronics to review the 1993 World Cup test events and to plan for the Olympics. Gregg will return the favor in January 1994 and others will join him when the Olympics take place February 12 through 27.



Don Ufford

Engineering alumnus hits the wall at high performance driving school

"I'd like to come back to South Dakota and do something significant," he said. "I would like to work with people in the state to improve the engineering opportunities so engineers could stay in South Dakota and enjoy life."

If variety is the spice of life, Don Ufford is cayenne pepper.

Always a thrill seeker, Ufford, a 1987 SDSU agricultural engineering graduate, craves new adventures, from white water rafting to cave spelunking to racing cars at top-notch speeds.

"It was great," Ufford said. "I got to drive a car to its limit with all the fuel supplied."

Ufford, an employee of the Ford Motor Company in Dearborn, Mich., was sent to the Bob Bondurant School of High Performance Driving in Arizona last April to learn how to safely operate cars under extreme conditions.

Ufford was taught how to handle, steer and brake modified Mustang GT and Formula Ford racing cars, to avoid obstacles in a car's path and maintain control of the vehicle. All the drivers were protected with fireproof suits, helmets and, emphasizing safety, were strapped into the single cockpit racing cars with harnesses.

During the training, everything was going smoothly — until Ufford hit the race track wall doing about 85 mph.

"It was an exciting wreck," he stated calmly. "I came up around a decreasing radius curve, accelerating hard, when the rear tires lost traction and I hit the (tire-packed) wall."

Luckily, he emerged unhurt and, after discussing the crash with his instructor, climbed right back into another Formula Ford racing car.

"I really enjoyed the training because I was able to push the car to its limits in a controlled environment where I was safely protected," he said.

The racing school trip was an

important learning experience for Ufford's job in the Advanced Vehicle Systems Engineering Department of Ford's Car Product Development Division. He will apply what he learned to designing new and better vehicles for everyone travelling highways of the future.

At Ford, Ufford's engineering duties vary from day to day. He

organizes design efforts for future car lines to limit or reduce

potential noise and vibration sources.

But designing isn't just about building; sometimes it's about destruction. One of the more interesting parts of Ufford's job is competitive benchmarking, where engineers study competitors' products down to the minutest detail.

"We purchase the best cars in the market and disassemble them to analyze their weight, how they were assembled, how it was manufactured and what their material types are," Ufford said.

In addition to engineering, Ufford recruits and identifies candidates for engineering positions

in his department as well as administers his department's budget by developing forecasts and strategies to meet budget goals.

Ufford's managerial efforts are bolstered by his two degrees, a master's in mechanical engineering from Purdue University in 1989 and a master's in business administration from the University of Michigan, which he is currently pursuing.

"I'm hoping to apply techniques I learned in my graduate studies to improve the product development process of manufacturing in the United States," he said. "As a nation we still have improvements to go through to remain a world class competitor."



One of Ufford's proposed improvements is to make engineers aware of customer input and encourage them to incorporate consumer ideas into future car designs.

"I try to be as involved as possible in creating opportunities for our engineers to meet customers and talk with them about their vehicle needs," he said.

Ufford believes successful manufacturing is supported by a triangle between business, government and education — three essential elements he compares to a three-legged stool.

"Like the three legs it takes to support a stool, to support the American economy, we need to recognize the importance of and support cooperative efforts between business, government and education," he said.

As part of his efforts to better understand the relationship between business, government and education, Ufford will spend July in Washington, D.C. studying business policy. His goal is to better understand the policy process so he can identify opportunities to make government policy makers aware of the needs of business, industry and education in their efforts to be world class competitors.

Ufford will study business policy from the process of formulation to the subsequent steps in the executive and legislative branches to the regulatory agencies.

"It is a good program because I will be able to interact with people involved with developing and implementing business policy, like legislators and lobbyists," he said.

Ufford believes well-rounded engineers should be involved with our government's business policies. He said government policies affect major engineering design considerations, like safety, vehicle emissions, imports/exports, international business and health care.

In his spare time, Ufford enjoys taking risks and trying new things. He once went cave spelunking in Tennessee near the Smoky Mountains.

"We crawled around on our bellies for eight hours," he said. "It was scary, but an amazing experience."

Ufford said the most frightening part of his trip was when he had to crawl 40 yards through a tiny, badger-like hole.

"It was so tight I had to turn my head sideways to get through it. I was so nervous, I just wanted to get out of there."

Ufford also believes in helping others through activities such as Boy Scouts and Paint the Town, a project for the underprivileged in Detroit.

"There are a lot of things out there to see and do and once I experience them, I want to share them," he said.

Ufford said other goals include living and working in Europe some day and owning his own business.

But whatever his future plans, Ufford hasn't forgotten his ties to South Dakota.

"I'd like to come back to South Dakota and do something significant," he said. "I would like to work with people in the state to improve engineering opportunities so engineers could stay in South Dakota and enjoy its many benefits."

Does he believe his plans will eventually become a reality?

"Someday, if I am dedicated enough it will work out. I enjoy South Dakota people so much. They are so rich in interests and humanness. They are wonderful people."

Ufford believes successful manufacturing forms a triangle between business and industry, government and education — three essential elements he compares to a three-legged stool.



Robert Risch

When Robert Risch was growing up on a farm near Elkton, he probably never imagined he would be named the 1993 South Dakota State University Distinguished Engineer. Risch graduated from SDSU with a

named Distinguished Engineer

bachelor's degree in electrical engineering in 1949. Until his retirement in 1991, he spent 42 years in public power, usually in an engineering or



management role, with an eye toward the bigger picture.

During his first job as an engineer with the Sioux Valley Empire Electric Association in Colman, Risch had the opportunity to bring electric power to rural areas that had never had been served.

Other positions he held included engineer for Northwest Iowa Power Cooperative, general manager for the Northeast

Nebraska Rural Public Power District, chief engineer for the Tri-State Generation and Transmission Association in Denver and executive director of the Missouri Basin Systems Group.

Risch was honored at the Distinguished Engineers Banquet at SDSU April 23. During his speech, he told the engineering students that education never ends.

He was involved in the engineering and management aspects of the first DC tie between two very large AC power systems, one in the west and one in the east. With the tie, the alternating current from one system is converted to direct current, then is converted back to an alternating current that matches the other system. Without the tie, electrical stability within the system is not possible.

"Because this tie used fiber optic technology, without continued education and learning, I wouldn't have been able to do it," Risch said.

Risch has a professional engineering license in South Dakota, Nebraska, Colorado and Wyoming and is a life member of the Institute of Electrical and Electronics Engineers. He also holds a current advanced amateur radio license. He is active in the Gideons International and is a past state president in Colorado.

His wife, Roberta, is also a South Dakota native and a graduate of SDSU. The Risches are residents of Estes Park, Colo.



Barb Dyer: a College mainstay

Barb Dyer, right, administrative assistant in the College of Engineering at South Dakota State University, takes a little time out during the 1993 Distinguished Engineer Banquet to share a hug with Judith Dobbs, a student who has been working in the dean's office at the College of Engineering. Dyer, who has worked at SDSU for 24 years, is a mainstay to the SDSU College of Engineering. As one co-worker said, "It's hard to describe what Barb does because she does so much!" For Engineering Exploration Days alone, Dyer successfully handles a multitude of duties, from brainstorming ideas for EED activities to overseeing the arrangements for the Distinguished Engineers Banquet.

Joan Trygstad

Joan Trygstad knows how rough the road can be for women engineering students. So she's doing something to help smooth the way.

Trygstad and her husband, Mike Carpenter, have pledged to fund the \$750 Leaders of Tomorrow Scholarship for SDSU women engineering freshmen for at least 10 years. Matching funds are being provided by Litton Industries Inc., of which Carpenter is Director of Intellectual Property.

Scholarships were vital to Trygstad during her years at SDSU, where she earned an engineering degree in December 1976 and a political science degree in May 1977.

"I lived for those scholarships," Trygstad said, "because loans were never enough."

The fund established by Trygstad will support an incoming freshman woman who wishes to major in any of the engineering disciplines. The fund will also make unrestricted support available to the dean of Engineering, who will utilize these

alumnae creates scholarship to encourage, reward women students

discretionary funds for the betterment of the College and particularly for programs that will benefit women in engineering. Uses may include support of activities of the SDSU chapter of the Society for Women Engineers, as well as activities that promote the recruitment and retention of women as students and faculty of the College of Engineering.

Trygstad said she feels some students shy away from applying for scholarships because they feel they have to be pulling straight A's to qualify. But to her, determination counts more than grades.

"I care more about the students who are dedicated to the profession and want to stay in it," she said. "I want to encourage more women to apply for engineering scholarships. Our society needs more women involved at all levels. I think we'd all be better off. They just need to know they're not oddballs."

When Trygstad chose engineering, she said lots of men told her not to do it. Sheer gumption kept her going.

"You have to be brave to sign up with Engineering, whether you're a man or a woman," she said.

"Engineering is put at such a (high) level in our society and once you do it, you have to be braver to stick with it. Being a woman has been a real factor in my success. It gave me the steel."

Trygstad was born and raised on a farm near Lily and graduated from Webster High School. She wanted to be an architect, but no architectural schools exist in South Dakota. With a brother in engineering and a sister in political

science at SDSU, she decided to join them for awhile, then transfer to Minnesota or Iowa. But her plans took a different course because, like any young person, "you don't know what you want to be until you be it," she said.

"After two years here, I did well in my courses and I decided, why not be a civil engineer?" she said. She was elected president of the student chapter of civil engineers. The vote was taken while she was out of the room; she returned to the surprise of her new post. "The guys nominated me," she said, "and I was just petrified."

After earning two degrees at SDSU, Trygstad went on to the University of Nebraska at Lincoln, earning a doctor of laws degree there in 1979. Law school, she said, "was a snap" compared to engineering school. During law school, she worked in Omaha as a law clerk at least 20 hours a week and still kept her grades up. "That's how valuable my engineering education was here at SDSU," she said.

Because she was first an engineer, Trygstad went into patent law. She and her husband are both patent attorneys in Los Angeles, Calif.

"That's how I stay abreast of technology," she said. "I see technology first-hand, being invented and brought into a corporation."

Trygstad wishes women were more aware of the vast opportunities available in the engineering field.

"When I was a student, I never even knew patent attorneys existed," she said.

Besides financial help, Trygstad assists the College of Engineering in other ways. She's on the Dean's Advisory Council. She'd like to help the College market inventions with commercial value.

"I want to put my energy toward something I value," she said. "I think this University is marvelous. As long as I have the time and the energy and the contacts, I want to help in whatever capacity I can."



Alumnae Joan Trygstad returned to SDSU in April to deliver the keynote address at the Distinguished Engineers Banquet and to attend a meeting of the Dean's Advisory Council. Trygstad earned two degrees from SDSU: engineering in December 1976 and political science in 1977.

Steve Jaques

Alumnus helps correct Chicago Flood

An SDSU graduate helped correct the "Great Chicago Flood," a high-profile problem that was solved quickly and effectively using specialty construction techniques.

Steve Jaques, who graduated from the SDSU College of Engineering in 1975, was project manager for the specialist grouting company, Hayward Baker Inc., that performed the final seal

on the freight tunnel system

that the Chicago River was flooding into in April 1992. Jaques is area regional manager for Hayward Baker Inc. in West Des Moines, Iowa.

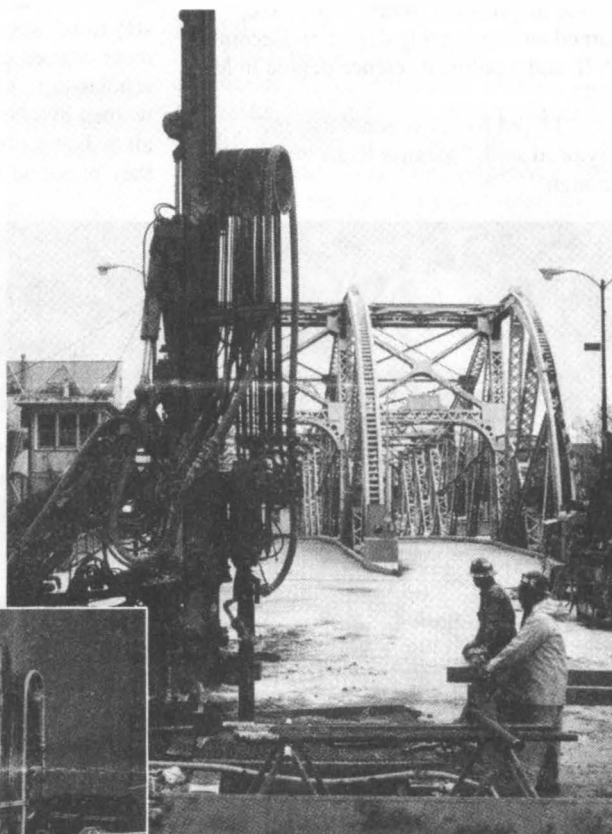
More than 40 miles of unused freight tunnels lies beneath Chicago's famous Loop. On April 13, 1992 a damaged tunnel running under the Chicago River collapsed, sending hundreds of millions of gallons of river water into building basements, parking garages and utility conduits throughout the central business district. A major concern was potential flooding in the Chicago Transit Authority subway. About 300 buildings were affected; potential losses were estimated at \$1.5 billion.

Two days after the collapse, a contract was negotiated with Hayward Baker to provide waterproofing for the

Chicago Transit Authority, particularly where the subway passed near the old freight tunnels.

Three days after the collapse, the contractor asked Hayward Baker for grouting services to strengthen tremie bulkheads which were being constructed to plug the damaged tunnel. Jaques flew to Chicago for contract negotiations and remained on site for two weeks, directing all grouting work.

Hayward Baker's team worked a double crew/double shift schedule around the clock during the Easter Holiday and through the following week, helping quickly seal off the flood. The company was one part of a cooperative action that joined contractors and engineers from across the nation with local, state and federal officials to respond to a major civil emergency.



Left: Hayward Baker provided equipment to maintain a double crew/double shift schedule around the clock. Above: The grouting operation was part of a cooperative effort involving contractors and engineers from across the country.

South Dakota State University is interested in YOU

Many companies have asked about the availability of engineering talent as they look at South Dakota for locating or expanding their operations in the state.

We would like to visit with alumni who would be interested in returning to the state.
Please mark the appropriate boxes below.

- I am interested in learning more about industrial development in South Dakota
- I am interested in starting a company or relocating a company in South Dakota
- I am interested in learning more about engineering expertise in South Dakota
- Would you be willing to be a guest lecturer or in some other way share your expertise with our students?

COMMENTS

Please return this form with your name, address and phone number, and direct your inquiries and comments to:

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