

A DYNAMIC FORCE THAT INITIATES MOTION TO A BODY OR SYSTEM

# IMPULSE

WINTER 1996



 SOUTH DAKOTA STATE UNIVERSITY  
COLLEGE OF ENGINEERING, BROOKINGS



## Dear Alumni:

This issue of the Impulse emphasizes our relationships with you, our alumni, and the people and industries that hire our graduates. These articles illustrate how people utilize the educational opportunities we provide, and interact with our faculty for technical information or specialized design and analysis. This broad range of interaction between us and the people we serve is critical to our students and also provides an important support function for economic development in our area. Our existing industries can take advantage of the many academic, research and technology transfer capabilities as well as a student pool of enthusiastic interns and part-time help. In addition, these capabilities are important to industries considering expansion or relocation to our state. Finally, and most importantly, these interactions provide a means for our faculty to see the needs of industry and thereby design our programs to properly prepare our graduates.

This issue of the Impulse comes to you at a time when we are identifying ways to be more efficient and more effective in providing the engineering, science, and engineering technology programs to campus students, non-traditional students, and place-bound students in other locations around South Dakota. We are also working with other Board of Regents institutions to capitalize on the availability of the statewide interactive TV network to share classroom duties, team teach courses, or cooperate in the delivery of entire programs. In addition, we are working with the technical institutes in the state to finalize articulation agreements for transfer of courses into our technology programs. These efforts will open up opportunities for us to more effectively serve industry and our students.

Progress on our space study has been slow over the past few months as we stepped back to determine what was feasible in a two step process. We felt our needs could only be accomplished in two phases and our consultants have been finalizing their recommendations based on that assumption. We look forward to their report in February.

Finally, you have heard from us during Engineer's Week, February 19-23, as our students conducted the annual Phonathon. They thoroughly enjoyed talking to you and learning about your career and the opportunities to which they can look forward. I am sure you enjoyed visiting with them and learning about the ongoing activities and needs of your particular department and the college.

Keep in touch with us and be sure to stop when you are near.

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

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**ABOUT THE COVER:** Employees at ENERCEPT Inc. in Watertown load a panel into a machine designed by Mike Monnens, program engineer for the SDSU University/Industry Technology Service. This issue of the Impulse highlights the variety of ways the College of Engineering works with businesses and industry throughout South Dakota, to the benefit of both SDSU and the economic development of the state.

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# Engineering

*listens to industry needs*

*"The state's engineering colleges are often an untapped resource by most of my counterparts in this state. They don't realize the tremendous benefits they have to offer us as small manufacturers."*

*This contact with industry also benefits SDSU.*

**W**hen South Dakota industries have needs, the SDSU College of Engineering listens. Four years ago John Devine, president and CEO of ENERCEPT and CEO of Benchmark Foam, both in Watertown, talked to SDSU College of Engineering Dean Duane Sander about small industries' need for engineers.

"We struggle at this level about when to hire engineers and what type of engineer to hire," Devine said. "Sometimes we need mechanical, sometimes electrical and sometimes civil. I told Dean Sander someone needs to prepare industrial engineers who have a range of skills they can bring to employers."

Based on this and other input, SDSU plans to begin a manufacturing engineering technology program in fall 1996 or spring 1997, pending approval by the South Dakota Board of Regents.

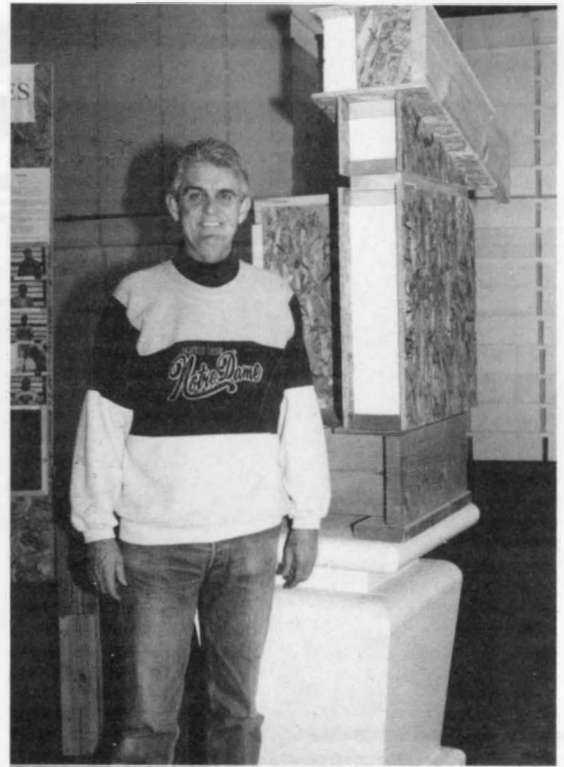
"South Dakota companies are important to the College of Engineering," Sander said. "We want to do what we can to provide them with highly-qualified and well-trained

engineers, technologists and scientists who meet the needs of the state's small industries."

Devine was the first employee at ENERCEPT in 1977, when it was called Energy Industries. He was the plant manager of the company, which produces foam products for insulation and packaging. In 1980 they began making panels for home construction and built their first panel home in Watertown in 1981. ENERCEPT was incorporated in 1982 and a plant was built to create panelized construction products.

In 1988 Devine and three other employees bought the assets of the foam company and changed its name to Benchmark Foam, which supplies the foam for ENERCEPT panels. Last fall Devine and another group of investors bought ENERCEPT. These are two separate companies, but with some common ownership. The two industries now employ 110 people.

Last summer Mike Monnens, program engineer for the SDSU University/Industry Technology



Service, designed a laminating machine for ENERCEPT.

"We've had excellent results and are very pleased with it," Devine said. "It has more than doubled our output capacity. We're considering building a plant like this in Seattle and would put a machine like that there."

ENERCEPT and Benchmark have also used the SDSU Engineering Extension and the SDSU Transportation Technology Transfer Service.

"The state's engineering colleges are often an untapped resource by most of my counterparts in this state," Devine said. "They don't realize the tremendous benefits they have to offer



us as small manufacturers.” This contact with industry also benefits SDSU.

“It gives us the opportunity to understand their requirements and the type of education they want from the students who graduate from SDSU,” Monnens said. “It also helps us identify projects that can be used for design engineering classes or research projects for master’s theses.”

Student projects currently underway include a ventilation system for a child care center and a material handling machine for an agricultural industry.

Devine feels a special tie to SDSU. He attended the University for three and a half years in the industrial arts program until it was discontinued. He then transferred to and graduated from the University of South Dakota at Springfield. He serves as a member of the SDSU College of Engineering Manufacturing Engineering Technology Advisory Council, which advises the College about how to support South Dakota’s economic development efforts through this proposed program.

“It’s critical to keep the lines of communication open between

industry and education,” Devine said. “They’re like a supplier; the product they’re selling is students. If we treat them like a good supplier, they treat us like a good customer. It’s important that each of them know what the other needs. The supplier needs to be tuned in or they will be creating products that people don’t need.”



*Clockwise from bottom photo, opposite page:*  
 •Employees at ENERCEPT Inc. of Watertown create and ship the insulated building panels the company manufactures.  
 •John Devine, president and CEO of ENERCEPT Inc., poses beside the insulated building panels. An SDSU engineer designed the machine that adheres the materials.  
 •Devine is pictured on the production floor.  
 •ENERCEPT employees stack and ship the insulated building panels.

# Rosco owner

*helps SDSU stay  
tuned to industry  
needs*

*“When there is good communication between industry and education, colleges can find what the needs of industry are and we find out how colleges can provide us with services and employees.”*

Because technology is changing at nearly the speed of light, it’s important for universities to know what industries expect of new engineering graduates.

“There’s no sense in putting engineering students on a drafting board anymore,” said Jim Maytum, director of engineering for Rosco Manufacturing Co. in Madison. “We need people who are computer trained. They need the ability to go and get the information that’s out there, not to reinvent the wheel.”

Rosco co-owner Shelly Knuths is helping the South Dakota State University College of Engineering keep up with the needs of industry by participating in the College’s Economic Development Task Force. The task force’s mission is to advise the College on how to support economic development efforts in South Dakota.

“One of the reasons I was chosen for the task force was because I am a member of the Governor’s REDI board that provides low-interest loans for South Dakota industries,” Knuths



*Jim Maytum, director of engineering for Rosco Manufacturing in Madison, design engineer Mark Helling and business co-owner Shelly Knuths show one of Rosco’s road maintenance machines. Knuths is a member of the SDSU College of Engineering Economic Development Task Force.*

said. "When there is good communication between industry and education, colleges can find what the needs of industry are and we find out how colleges can provide us with services and employees."

Rosco, a nationally-recognized manufacturer of road maintenance equipment, was originally founded in 1928 in Minneapolis. It moved to

is drastically different than when I went to school," Maytum said. "It's getting more technical all the time. Graduates are going to need advanced education and skills."

Other SDSU graduates employed at Rosco are Eric Lewis, a 1988 mechanical engineering graduate who is project engineer for patchers and sweeping machines, and Mark Helling,

*"It's getting more technical all the time. Graduates are going to need advanced education and skills."*

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Madison in 1983 after Knuths and her husband, Leroy, purchased the company and has grown from 57 employees to its current 130. The company has 75 dealers in the U.S. and Canada. The Knuths personally visit all 75 dealers every two or three years to keep up with their needs.

SDSU has provided Rosco with both information and employees. Mike Monnens of the SDSU University/ Industry Technology Service has given technical research and information about accessing the Internet.

Engineering Extension has advised the company about OSHA regulations.

Maytum, a 1961 bachelor's degree and 1968 master's degree graduate in mechanical engineering, worked at Caterpillar, Koehring and Blount before coming to Rosco last April. He also taught two years at SDSU.

Engineers at Rosco are responsible for new designs, updates and product reliability at the plant. He said South Dakota has more engineering opportunities now than in the past.

"When I graduated from SDSU, I wanted to go west," Maytum said. "The closest I could get was Caterpillar in Illinois. Now, South Dakota has a good industry base with many challenging careers."

The engineering field is becoming more challenging every day, so graduating students must be prepared. "What we ask engineers to do and the speed with which we ask them to do it

a 1973 mechanical engineering graduate who is design engineer for tank products.

## Engineering Extension *help companies' safety*

ENERCEPT and Benchmark Foam of Watertown (see pg. 2) and Rosco Manufacturing in Madison (see pg. 3) are three of the numerous businesses that have been assisted by the SDSU Engineering Extension. Engineering Extension helps private and public entities with occupational safety and health surveys of workplaces and training workshops to update safety skills.

"The most important thing we do is protect workers from injury and illness," said Jim Ceglian, Engineering Extension program director. "Because most employers don't have the resources to develop programs themselves, we help them make their workplaces safe for their employees."

During on-site visits, staff members inspect and analyze the workplace and tell the manager/owner what to do to meet U.S. Occupational Safety and Health Administration standards.

"An average lost work day accident costs the employer \$12,000 in lost time and medical costs," Ceglian said. "That's where we can help them economically. When they get their accident rate down, they get a lower rate for worker's compensation insurance. It's just an added benefit of having a safe work program."

For more information about SDSU Engineering Extension and on-site visits, contact Jim Ceglian at (605) 688-4101.

# Motorgrader removes snow with a wing and a plow

*The video gives tips important in winter operations, which include operating and maintaining the machine, removing snow on different types of road surfaces, using the V-plow, winging techniques and much more.*

**S**now removal on rural roads is a big job for the person operating the plow. Knowing how to handle and maintain the plow is a vital part of the job.

That is why South Dakota Transportation Technology Transfer Service (SD T3S) at SDSU, Caterpillar Inc. of Peoria, Ill., and the Balderson Co. of Wamego, Ks., which makes attachments for Caterpillar equipment, are working together to produce and distribute a training video, "Operating a Motorgrader with a V-plow and Wing."

"Requests for this kind of training is common in the Plains states, where graders are used for snow removal on rural roads," said Ken Skorseth, T3S field operations manager. "The primary viewing audience will be new operators in governmental departments and private industry."

The video gives tips important in winter operations, which include operating and maintaining the

machine, removing snow on different types of road surfaces, using the V-

plow, winging techniques and much more.

Skorseth, assisted by county highway advisers, wrote the script for the video, and Caterpillar and the Balderson Co. have

hired a production crew to shoot the field footage and do the editing and voice over. When the first draft is ready, SD T3S will review the video.

"We provide the technology for the video and Caterpillar and Balderson provide the funding," Skorseth said.

T3S was established at SDSU in 1988 with a satellite office at South Dakota School of Mines and Technology to provide local street and road departments with technical information regarding road and bridge operation and maintenance. The information is given through a toll free number, 1-800-422-0129, a series of workshops, seminars and short courses on transportation technology, a library of printed and video information and a free quarterly newsletter. The center operates in a similar fashion to USDA extension services, with the exception that T3S specializes in roads and bridges.

The largest program T3S handles is the one-day gravel maintenance seminar. During the "training season," from late November through March, Skorseth conducts seminars for county highway departments, townships and contractors who work for the departments in eight Mountain and Plains states, including South Dakota.

"The seminar is the biggest thing we do because in South Dakota, almost three-fourths of the local roads are gravel," Skorseth said. "We found that only one other university — Oklahoma State University in Stillwater — provides this extension training in the United States."

Skorseth has given the seminar for more than 5,000 people in the last six years. The seminar agenda includes "What Is Good Gravel?" "What Is Adequate Crown On the Road?" "Dealing With High Shoulders," "Pit Operations," "Fabric Stabilization," "Effects of Today's Traffic On Gravel Roads" and the most popular item, "Dealing With Washboard." Skorseth said frost and short seasons are to blame for many of the road maintenance problems.

Skorseth had 21 years experience in the highway and heavy construction/maintenance industry, including eight years as Deuel County superintendent, before becoming SD T3S field operations manager at SDSU.



*Ken Skorseth, T3S field operations manager, is working with Caterpillar Inc. and the Balderson Company to produce and distribute a training video. Skorseth wrote the script for the video, with the help of county highway advisers.*

# Task force studies how Engineering can boost economic development

*"I asked for names of people who would represent South Dakota and be knowledgeable about economic development and the needs that the College of Engineering could fill."*

The SDSU College of Engineering, in an effort to better serve the needs of its graduates and South Dakota's economy, has created the Economic Development Task Force.

The Dean's Advisory Council recommended the development of a task force at its spring 1995 meeting, said Duane Sander, dean of Engineering. "They made the recommendation primarily because the Dean's Advisory Council is made up of people throughout the country, and they are not as familiar with South Dakota's economy," he said. "They suggested a task force to advise the College on how to position itself to support economic development efforts in South Dakota."

Sander developed the task force by first contacting Ray Trankle, president of the Industry and Commerce Association of South Dakota. "I asked for names of people who would represent South Dakota and be knowledgeable about economic development and the needs that the College of Engineering could fill," Sander said.

Trankle was pleased to be asked. "I was appreciative that Dean Sander and other members of the College of Engineering were interested in reaching out to industry in the state to say, 'This is what we do. How are we beneficial, and how could we improve?'"

The task force met for the first time Oct. 12 at SDSU. "During our discussions at that

related to their work in economic development and some needs their office has identified."

Now, Sander is visiting individually with each task force member to learn what information they still need. Before the Dean's Advisory Council meets again this spring, the task force will reconvene to review that data and begin planning for the College's future.

"This might entail continuing with a number of our programs and support functions," Sander said. "It might entail upgrading some of our functions or adding new responsibilities, not only to support existing companies as they expand or continue to develop their products, but also to attract additional industries or spawn new industries from our South Dakota population."

Through the economic development process, the College of Engineering hopes to improve the programs it offers its students, Sander said. "We want to assist in any way to develop jobs for our graduates as well as encourage our graduates to think in terms of entrepreneurship and in terms of developing their own



products and companies," he said. "In order to do that, we feel it's important that not only the College of Engineering, but higher education provides as much support as possible."

Economic development can also help keep graduates close to home, Sander said. "Our student body is very interested in finding jobs within our region as opposed to moving out to either coast, and it is important to assist in the support of our economy so that jobs are available when these students graduate," he said. "Hopefully, everyone wins."

State businesses will benefit not only by hiring SDSU's better prepared graduates, but also by making use of the teaching and research capabilities of the College, Sander said. "It directly



The Task Force met for the first time Oct. 12. Pictured above: Seated: Shelley Knuths, Ginger Thomson, Ron Wheeler, Lynn Anderson, Mary Bibby, John Bibby. Standing: Merle Lewis, Al Kurtenbach, Jerry Luetzow, Richard Coddington, Dan Murphy, Jerry Johnson, Leo Reynolds, Don Patrick, Jerry Lohr, Ray Trankle, Lisa Rose, Kevin McIntyre.

meeting, we did two things," Sander said. "First, we familiarized the task force with the present College of Engineering. Second, Commissioner Bonnie Untereiner from the Governor's Office of Economic Development provided background



affects them in terms of having continuing education for their employees and having the research and technology transfer capabilities of the University at their disposal.”

Lynn Anderson, vice president of marketing and public affairs for DM&E Railroad, believes the work of the task force can benefit the whole state. “We want to make sure the College has relevant, cost-effective programs for the taxpayers of the state and is producing the kinds of graduates needed,” he said. “They’ll help us attract new industry and grow existing industry. Those are all things we should be striving for.”

One thing the task force has already helped accomplish, Trankle said, is to indicate how much business leaders know about the College’s activities. “One overall objective was to really see what kind of awareness existed in industry of the benefits the College of Engineering is providing,” he said.

Heightened awareness of the services SDSU offers will be beneficial to many businesses, Anderson said. “The University is a good resource for us,” he said. “Its services and expertise could be used around the state. It’s important to get the word out so people know what is available to them and can tap into those resources.”

To meet these goals, the College of Engineering wanted a task force made up of people from

all types of businesses, Sander said. “The members of the task force are from a wide range of backgrounds,” he said. “That was deliberately done in order to have a good mix of opinion and information coming from the breadth of the South Dakota economy.”

That variety enhanced discussion at the group’s first meeting, Trankle said. “It was interesting to see the non-engineering members of the task force ask questions that most people involved with engineering wouldn’t ask, and it was interesting to put ourselves in the response mode,” he said. “It brought out things we ordinarily wouldn’t have thought of.”

However diverse the task force members are, Anderson said, they share the desire to improve the working relationship between the University and industry in South Dakota. “People come in with different perspectives, and I think that’s good,” he said. “The common thread among the people I’ve talked to is an interest in developing the state and the companies around the state.”



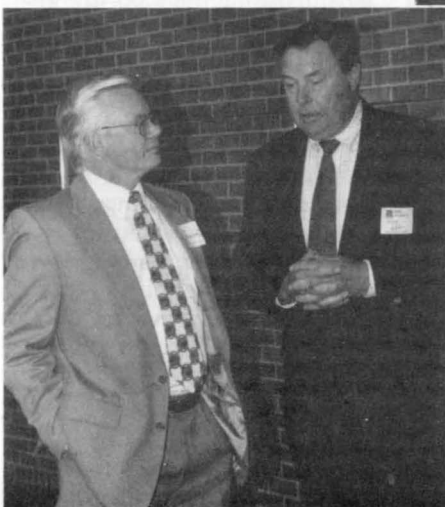
*From the top:*  
Don Patrick, economic development director for the Brookings Area Chamber of Commerce, discusses a speaker’s remarks with Shelley Knuths, director of administration for Rosco Manufacturing Company.

*Duane Sander, dean of the SDSU College of Engineering, shares ideas with Ron Wheeler, president and CEO of Telelect Inc.*

*Lynn Anderson, vice president of marketing and public affairs at DM&E Railroad, talks with Jerry Lohr, president of J. Lohr Winery and J. Lohr Properties.*

## Members of the Economic Development Task Force

Ray Trankle, Sioux Falls; Lynn Anderson, Brookings; John Bibby, former legislator and businessman, Brookings; Mary Bibby, former legislator, teacher and White House employee, Brookings; Alan Bowden, president and CEO of Sencore, Sioux Falls; Gary Conradi, vice president of corporate services for Raven Industries, Sioux Falls; Steve Egger, president of Egger Steel Co., Sioux Falls; Thomas Everist, president of L.G. Everist, Sioux Falls; Jerry Johnson, Dean of the University of South Dakota School of Business, Vermillion; Shelley Knuths, director of administration for Rosco Manufacturing Co., Madison; Al Kurtenbach, president and CEO of Daktronics, Brookings; Merle Lewis, president and CEO of Northwestern Public Service Co., Huron; Jerry Luetzow, president of MTR, Brookings; Jack Marshman, president of Sioux Falls Construction; Dan Murphy, president and CEO of First Bank, Sioux Falls; Gary Olson, president of Norwest Banks, Sioux Falls; Don Patrick, economic development director for the Brookings Area Chamber of Commerce; Leo Reynolds, president of ESI Electronic Systems, Sioux Falls; Ginger Thomson, co-owner of TV Productions, Brookings; June Thormodsgard, chief of the science and applications branch of EROS Data Center, Sioux Falls; and Ron Wheeler, president and CEO of Telelect, Watertown.



*“Seven or eight years ago we had very little technical interaction with SDSU. Today we have ongoing activities with the College of Engineering that are real flagships for both.”*



## EROS/SDSU connection ‘heavenly,’

**W**hat’s happening in the heavens impacts some cooperative efforts here on earth. The EROS Data Center works with the SDSU College of Engineering on projects involving image processing of satellite data, the characterization of sensor systems and other satellite-related information.

“Seven or eight years ago we had very little technical interaction with SDSU,” said June Thormodsgard, chief of the EROS Science and Applications Branch. “Today we have ongoing activities with the College of Engineering that are real flagships for both.”

The center links South Dakota to the aerospace industry, the U.S. Department of Interior and the U.S. Geological Survey.

“The EROS Data Center brings in ideas and technology that otherwise wouldn’t be present in the state,” said Dennis Helder, director of the SDSU

Engineering and Environmental Research Center (EERC). “It has allowed for interaction with students and faculty in a way that has significantly enriched the careers of the faculty and provided guidance to students who have been involved in projects over the years.”

Since 1991 EERC associate director Kevin Dalsted and professor emeritus Fred Westin have worked with EROS concerning African drought situations and how American aid can be dispersed there. Currently, the men are examining satellite images of the West African country Mali to assist in famine early warning systems.

“There is no other practical way to determine this information except through Landsat data,” Westin said. “When you have such a large area, you need to use a system of crop use intensity. If you can see every field, there’s too much detail. Here we see clumps of fields and get a general sense of where the cropping is.”

The two recently completed a study of Mozambique, which was involved for several years in a civil war that ended in 1993.

“We examined remote sensing images in one area to see what happened before and after the war,” Westin said. “Agriculture nearly ground to a standstill during the war. Now we can see that the land under cultivation has increased significantly, but not yet to the level of the pre-war peak.”

“This information was asked for by relief agencies working in the country,” Dalsted said. “U.S. money is paying for roads to have land mines removed and to be rebuilt, so the agencies can monitor the progress of cropping as

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*Fred Westin, professor emeritus of plant science and remote sensing, and Kevin Dalsted, associate director of the Engineering and Environmental Research Center, examine a remote sensing map of the African country, Mali. The two are working with EROS Data Center to help Mali detect possible famines.*

refugees return. The results have been well received."

To ensure that the information Westin, Dalsted and others receive from the satellites is correct, Helder and Stephen Schiller, SDSU associate professor of physics, work with the satellite instrument and degradations in the atmosphere.

"If, for example, you wanted a scene from West Bend, Ind., in 1989 so you could compare it to today, you would need to check the instrument calibration to make sure the picture was taken in the same place in the orbit," Helder said. "Also, you need to take into account the detector gain to ensure the change you see in the satellite picture is because of something that happened on the ground and not because of changes in the instrument."

Helder's area of expertise is radiometric calibration, the ability to accurately convert digital satellite images into energy or radiance. He concentrates on radiometric degradation in Landsat instrumentation.

"I look at the EROS archives back to 1982, extract the instrument calibration files and analyze them as a function of time," he said. "The instrument changes in a predictable manner. We're analyzing the variations so we can characterize them and remove them from the data."

Currently Helder is studying the instruments on Landsat 4 and 5 so that better calibration can be applied to Landsat 7, which is scheduled to launch in 1998. The new satellite will have an image assessment system that will assess the quality of the Landsat images on a regular basis.

Other errors in satellite imagery can occur because of atmospheric effects. Schiller's research involves developing and improving capabilities to correct for these effects.

"When you collect images from space, the satellite sees the way it appears through the atmosphere, so it's not seen the same way as someone would see it on the ground," he said. "Because of scattered light, the darker surfaces can appear bluer and bright surfaces appear redder. I help provide image processing correction and transform the image like it would be if there were no intervening atmosphere."

Schiller sets up equipment on the ground to measure reflectance at a

target, then checks to see if, when corrections are applied to the satellite images, it is what he sees on the ground.

"The point is to be able to make sure you're getting the absolute units correct," he said. "When you're studying changes in environmental conditions, you have to make sure you're not looking at changes in the atmosphere, but actual changes over time."

Schiller currently is an investigator in a project funded by the French government to measure how its new satellite, VEGETATION, can be used to study the grassland environment at the Niobrara, Neb., Nature Conservancy Reserve.

Through the NASA Space Grant Consortium at SDSU, faculty members have studied at EROS during the

summer. But students have also benefited from the SDSU/EROS connection.

"Through collaboration with the College of Engineering, students have been employed through government and contractor internship programs," Thormodsgard said. "This is another example of a benefit to both parties. The students not only learn a lot, they get a focus for their future work."

They also benefit because some EROS-related projects bring new equipment.

"The things we are doing with them are cutting-edge," Schiller said. "The interaction provides SDSU with equipment that allows us to do other projects, as well. The relationship works well for all involved."

## Program helps meet manufacturing needs

Industries that want to be more efficient or that have engineering and research problems can turn to an SDSU program for assistance. The University/Industry Technology Service (UITS) links SDSU resources to industry, business and government to solve technical problems and enhance economic development in South Dakota.

One resource is mechanical engineering instructor Mike Twedt who conducts manufacturing innovation and efficiency studies and helps with other engineering problems.

"Manufacturers could call with a problem, like a system that's not working properly," Twedt said. "Based on their problems, we look at the time frame and budget to decide if it should be an undergraduate design project, a master's thesis research project or a specific faculty project."

It's a win/win situation for the manufacturer and for SDSU.

"The manufacturer gets the problem solved and the University gets more expertise, whether it's students or teachers," Twedt said. "It builds good relationships that can continue in the future."

Twedt is a mechanical engineer with a strong industrial engineering background, particularly in the area of optimizing the efficiency of manufacturing facilities.

"The manufacturers who use this program are often the smaller, more competitive ones in the area," he said. "I'd like to do anything I can do to help. In addition, the College of Engineering likes to see South Dakota's industries doing well."

For more information about this and related programs, contact Kent Rufer or Mike Monnens at UITS at (605) 688-4184.

# Industries support, supply SDSU Ground Source Heat Pump Laboratory

*"It benefits the state and the University, particularly, in that we're making a name for SDSU in the heating, ventilation and air conditioning industry."*



**G**round Source Heat Pump Training and Research Laboratory provides the training, marketing assistance and research regional businesses need. It could not do this, however, without the support of industries and electric utilities. Many companies supply funds, equipment and input to make the laboratory and its work possible.

Charles Remund, associate professor of mechanical engineering and director of the GSHP Lab, said outside support has been crucial to the lab's development.

"The lab was created in a partnership atmosphere with the state of South Dakota, the city of Brookings and the Brookings Area Development Corporation," he said. "Many utilities and equipment manufacturers were big supporters. Without any one of them, we might not be here. Their support is essential."

Many utility companies support the lab with funding, either by making yearly contributions or by recruiting people for training at the lab and paying part or all of the cost.

Several regional heat pump equipment manufacturers have donated equipment and supplies. Some companies have also sent personnel to assist with training sessions.

Chuck Hulet, manager of marketing for Otter Tail Power Co. of Fergus Falls, Minn., said most of his company's marketing staff and many of its contractors and trade allies have received training at SDSU's lab. Otter Tail supports the GSHP lab partly because its training is specifically

geared toward the applications of heat pumps in the northern climate.

"One of the problems we've had is that the heat pump concept started in the southern part of the nation and moved north," Hulet said. "When we heard of the potential for a training center in this area, we were enthusiastic. We, of course, wanted to support a facility that would train our people in northern heat pump applications, because we have a dominant heating load rather than cooling."

Hulet has been impressed with Remund's desire to constantly improve the training curriculum to make it as specific and relevant as possible for all participants. The constant application of research results also keeps the training current, Hulet said.

"I feel much more comfortable because they're on the cutting edge," he said. "We are very pleased with the laboratory and with the leadership we have in that area."

Econar Energy Systems of Elk River, Minn., has donated equipment to SDSU, both for heating and cooling the lab itself and for hands-on training. Scott Jones, sales manager for Econar, also helps with many of the training sessions offered at the lab and enjoys that involvement.

"You get to stay in front of people, to use the knowledge you have and to make some contacts," Jones said. "Where else can you have a room full of people who all want to know how ground source heat pumps work and how to install them?"

While Econar also does some training at its own plant, Jones has

been pleased with his experiences at the SDSU lab and is considering sending all the company's potential dealers to Brookings for training. The presence of the SDSU lab has increased interest in ground source heat pumps throughout the northern plains region, Jones said.

"I think Dr. Remund has done a wonderful job in promoting the industry and training contractors," he said. "It's also nice for us to know there's someplace in the region where we can have research done."

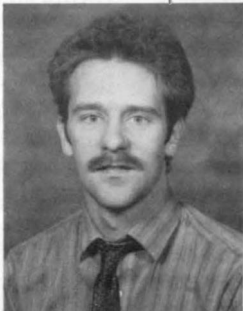
The collaboration between university and industry is profitable to the entire region the lab serves because it allows for the spread of knowledge and skills, Remund said.

"It benefits the state and the University, particularly, in that we're making a name for SDSU in the heating, ventilation and air conditioning industry," he said.

Utility supporters of the lab include Basin Electric Power Company; Black Hills Power and Light; Brookings Municipal Utilities; Codington-Clark Electric Cooperative; Corn Belt Power Cooperative; East River Electric Power Cooperative; Interstate Power Co.; Midwest Power; Missouri Basin; Nishnabotna Valley Rural Electric Cooperative; Northern Electric; Northern States Power Co.; Otter Tail Power Co.; Rushmore Electric; Southwestern Minnesota Cooperative; Superior Water, Light and Power; Traverse Electric; and West River Electric.

Equipment manufacturers supporting the lab include Addison Products, Advanced Heating Supplies, Bard, Carrier, Climatemaster, Econar Energy Systems, Florida Heat Pump, Geo-Flo Products Corp., Gyp-Crete Corp., McElroy Manufacturing, Phillips Petroleum, Trane, Vanguard Plastics and Water Furnace.

*Allan Skouby of Phillips Driscopipe talks to Steve Lehner, Efron Trueblood, Timothy Wendt and E. Norman Harrold, participants in the Ground Source Heat Pump Training seminar held at the SDSU Ground Source Heat Pump Laboratory in August.*



## Ground Source Heat Pump Laboratory moves toward accreditation

Ground Source Heat Pump Training and Research Laboratory is moving toward becoming an accredited training facility. About two years ago, the International Ground Source Heat Pump Association (IGSHPA), of which SDSU's lab is a member, decided to require accreditation for all training labs, said Charles Remund, associate professor of mechanical engineering and lab director.

Remund served on a subcommittee which wrote IGSHPA's accreditation document, specifying the procedures, environment and equipment a lab must have to become accredited. Since that document was finished, SDSU has applied for an accreditation visit, which Remund hopes will happen this spring.

In a few years, facilities will not be able to offer training unless they are accredited by IGSHPA. This will have a positive effect on the industry by guaranteeing the quality of training procedures and facilities, Remund said. "I want accreditation because it tends to ensure that the only people in the industry are those who are truly into it," he said.

While accreditation is an important step, it does not guarantee that the lab will have the money it needs, Remund said. Another recent development will increase the lab's possible funding sources.

The Geothermal Heat Pump Consortium, a group made up of electric utilities, manufacturers and federal government agencies such as the Department of Energy and the Environmental Protection Agency, is developing a list of requirements that training facilities must meet to get consortium grants. SDSU's lab recently joined the consortium.

While the lab has done well in getting research grants, the consortium could provide more funding for training, Remund said. He looks forward to an upcoming request for proposal.

"We look forward to that opportunity," he said. "This grant would be targeted at the training facilities, not the research component."

## Remund takes over as director of Prairie Heat Pump Association

Personnel at SDSU's Ground Source Heat Pump Training and Research Laboratory have taken on another challenge. Since October, they have been handling the administrative tasks of the Prairie Heat Pump Association (PHPA).

The PHPA is a contractor-based association that promotes both ground and air source heat pumps. Charles Remund, associate professor of mechanical engineering and director of the GSHP lab, is now the association's executive director. Kris Jeppesen, research associate at the lab, is in charge of technical support.

When the previous administrators of the PHPA went on to pursue other business opportunities, the association was dormant for a few months. Over 90 percent of its members who responded to a survey voted to transfer administration to the SDSU lab rather than abandon it, Remund said. "If we hadn't taken it over, it might not exist anymore," he said.

Since SDSU assumed the administration of the PHPA, its focus has switched to technical support rather than marketing, Remund said. Jeppesen fields many phone calls from contractors and others requesting assistance or information. Occasionally, he or Remund will visit a site to help with designing, sizing or analyzing a system. The PHPA has more than 50 contractor members. "We're hoping to grow that every year," Remund said. "We offer services that, really, none of the other associations do."

# Mechanical engineering programs assist regional businesses

*"The key emphasis is on having students involved so they get to practice the knowledge they've gained in the classroom and get some hands-on experience in how plants operate."*

**T**he threefold mission of a land-grant university includes teaching, research and service. Two mechanical engineering programs, the Industrial Assessment Center and the Ground Source Heat Pump Training and Research Laboratory, help SDSU fulfill that mission by training students to work with industries in the region.

The Department of Energy Industrial Assessment Center (IAC) serves industries in a four-state area around Brookings, said Kurt Bassett, assistant professor and program director. Faculty-student teams visit manufacturing and processing facilities to analyze their energy use and prepare reports recommending waste-reducing and cost-saving measures.

Although each report goes through extensive review before being presented to the company, students are primarily responsible for writing it, Bassett said. "The key emphasis is on having students involved so they get to practice the knowledge they've gained in the classroom and get some hands-

on experience in how plants operate," he said. "Of all the aspects of the process, that's the most successful from our point of view."

For the businesses, the main advantage of an assessment is the potential cost savings. Rod Pierson, a 1986 SDSU graduate and manufacturing engineering manager at Toshiba America Information



Systems in Mitchell, said he was pleased with the results of his company's recent IAC review.

"They went into a lot of things we hadn't thought of before and gave us some new things to look at," he said. "We appreciate any assistance we can get from the University because in certain areas they have expertise we can use to help save money."

Greg Jaroch, plant engineer at the Heartland Food Company in Marshall, Minn., said the team that assessed his company's energy use saw savings opportunities that employees did not have time to look for. "It's like having two or three other people come in and work for you on all the little things that you know will save you money but that are too insignificant to spend your time on," he said. "It really adds up."

Jaroch was also impressed with the serious, professional demeanor of the students who visited the plant. "I would have considered any one of them for employment," he said. "They seemed to be very competent, qualified people, and they approached it very

methodically. As an engineer, that's something you look for."

SDSU senior Nathan Holden, in his second year working with the IAC, said he has gotten valuable practical experience through his involvement in assessments. The work has reinforced the importance of deadlines, he said, and has taught him an important business lesson. "We hardly

recommend anything if it's not a two- or three-year payback at the outside," he said. "The dollar is the bottom line."

Kristi Heisinger, manufacturing engineer at the Eaton Corporation in Spencer, Iowa, earned her bachelor's in mechanical engineering in 1993 and her master's in industrial management in 1995, both from SDSU. Working on assessment teams as a graduate student taught her everything from phone skills to product research, she said.

"It was a real advantage, especially to what I do now, because it gave me the chance to tour a lot of types of facilities," she said. "The audits themselves gave me a better understanding of how building systems work. I got a real-life picture of things

instead of learning them out of a book, and it made the things we learned in class seem real."

Students gain similar benefits through working at SDSU's Ground Source Heat Pump Training and Research Laboratory, said Charles Remund, associate professor and lab coordinator. The lab currently employs four graduate and nine undergraduate students to do research and occasionally assist with the one day training seminars or three-day certification workshops the lab offers to contractors.

Because the lab is the only one of its kind in the Upper Midwest, its employees stay busy serving utilities and other companies in as many as 12 states. The students have a lot of responsibility, Remund said.

"These people usually don't even have time to turn around," he said. "Eight hours isn't even a start on a day for them."

Much of the students' research, which ranges from grouting and soil study to instrumentation design, will be

put to practical use to improve ground source heating systems. Galen Streich, a graduate student in mechanical engineering, is working to determine which materials form the best grout to fill the hole bored to install a heat pump.

"It's an exciting area because it's fairly new technology," he said. "Ground source heat pumps are not readily accepted by the general population. But they are growing and seem to be a really good method for heating and cooling residential and commercial property."

Streich also hopes his background in practical research will make him attractive to employers when he graduates. "You never know exactly what they're looking for, but I think they'll see this as good experience."

Area industries benefit from the training and research that goes on at the lab as much as students do, Remund said. "Our biggest asset to the region is the technical information we give out to people involved in all aspects of heating and cooling inside and out of the state," he said.

The lab's work is especially important because much of the original development of heat pumps was done in the South, where cooling is the biggest concern, Remund said. SDSU's research focuses specifically on developing more efficient heating systems for the region's cold winters.

For that reason, Tom Holt, member services and marketing supervisor for East River Electric in Madison, has supported the lab's development from the beginning. "Having a facility like this located in the northern climate definitely has a lot of advantages," he said. "Being able to test equipment, research loop installations and pass that information on to people in this area is very beneficial."

Collaboration between the University and industry benefits not only the parties involved, but all area residents, Holt said. "East River Electric is very happy to work with SDSU and Dr. Remund in the development of the lab," he said. "We think it's very important to have a facility like that in this area."

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*Galen Streich, mechanical engineering graduate student at SDSU, adjusts the flow of air and solid particles into a pipe while working on his thesis project. He is trying to determine the best method for placing grout to fill the hole bored when a heat pump is installed.*

## Internships, other collaborations benefit SDSU students, industry

**M**echanical engineering students need real-world experience and companies need extra workers. Cooperative opportunities like student internships, co-ops and design projects meet the needs of both.

While the SDSU Department of Mechanical Engineering does not require students to intern or do co-op studies, it highly recommends them, said Don Froehlich, professor and department head. Many of the department's students do an internship or a co-op, a multiple internship with the same company.

One such student is senior Jason Devine, who is in a co-op program with 3M. His co-op includes three separate work periods during which Devine does not take classes, but works full-time for the company.

Devine said his co-op has helped him in several ways. "First, I got the work experience and the chance to see the different opportunities that I might have when I graduate and the job opportunities that are available in mechanical engineering. I was also able to see the real-life applications of what we learn in the classroom."

He was treated like a professional at 3M, Devine said. "They were really receptive and always helpful. There are a lot of co-ops that work with 3M, so I think they become accustomed to that situation and appreciate having co-ops work for them."

Student workers can be valuable to a company, said Scott Yukel, manufacturing engineer and co-op coordinator at the Brookings 3M plant. "It gives us a chance to develop future potential employees," he said. "We also get a lot of good work done by the students. I don't think we've ever had a bad experience with students here in Brookings."

A 1993 SDSU graduate, Yukel understands the benefits of co-ops from both sides. He worked for 3M as a student and believes that experience was a factor in his getting a permanent position there.

SDSU senior John Heckel is sure his experience interning at Graco in Sioux Falls will help him find employment. "It's already given me a

benefit in interviews, because people see I'm familiar with standards and processes. In engineering, with no practical experience, it's tough to get a full-time job."

Zan Vicino, cell leader at Graco, supervised Heckel and said he helped the company use its money and personnel more efficiently. "It helps a lot, because there are a lot of short-term, beginning-to-end projects that an engineer can do, but an intern can do, too," he said. "It's more cost-effective for us to have someone with some background and experience do those jobs while the engineers take the higher priority, bigger payoff projects."

Everyone involved benefits from an internship, Vicino said. "From a business standpoint, it's been very profitable for the company," he said. "It think it's also been profitable for John as far as getting experience."

Students and professionals gain similar benefits through sophomore and senior design class projects. Froehlich said. "Within those classes there are teams of students put together to work with companies on the design of a product or a system," he said. "It's a really good arrangement. It puts the student teams in real-world situations and it helps the companies with their products."

Dave Lucas, production supervisor for displays and refurbishing for Larson Manufacturing in Brookings, saw those benefits when a team of SDSU senior design students worked to make one of the company's display door line operations more efficient. By suggesting modifications in work stations and procedures, the students helped increase productivity from an average of 80 doors in a 10-hour day to a high of 242 doors in an 11-hour day.

"We took the students' ideas, our ideas and the crew's ideas and formed a line that is top-notch and efficient," Lucas said. "It was a big benefit for us, much needed and much appreciated."

# Students gain real-world experience working for Raven, Aerostar

*"When a person comes out of school, crossing that bridge from knowing theory to understanding what an engineer actually does is a big learning curve. An internship helps them to be more ready for that transition."*

Testing inflatable decoys for the government and designing dust collection systems for industry are tasks many college students only read about. A few, however, actually take on those responsibilities through internships or temporary jobs. Raven Industries and Aerostar are two companies that offer such experiences to SDSU students.

Interns come to Raven in a variety of ways, said Barb Ohme, human resources manager. Some seek out the opportunity by sending their resumes to Raven or contacting specific departments, while others get the positions more informally through personal contacts. Depending on the job, an intern may or may not receive pay or college credit.

Students from many majors work for Raven, and all of them can benefit from experiencing the demands of a job, Ohme said. Engineering students, in particular, learn to apply their knowledge.

"When a person comes out of school, crossing that bridge from knowing theory to understanding what an engineer actually does is a big learning curve," she said. "An internship helps them to be more ready for that transition."

Internships also help students learn more about the career paths open to them, Ohme said. "It gives them a chance to view industry in general and Raven in particular," she said. "They may make some decisions about what kind of work they really want to do."

Beth Lynn, a December 1995 graduate of SDSU's mechanical engineering program, worked full time in Raven's Plastics Division during the

summer of 1994. The internship provided her with many useful experiences, she said.

Lynn researched and wrote a proposal for a dust collection system to improve the air quality in areas where Raven employees work with fiberglass. She also spent time updating files of hand-drawn designs by replacing them with Computer Aided Design drawings. "It was a positive experience," Lynn said. "I really enjoyed it. It's a good way to get some real-world experience, and everyone wants that when you're looking for a job."

John Mahoney, manufacturing manager in Raven's Plastics Division, supervised some of Lynn's work. He agreed that work experience benefits graduates on the job market.

"As an employer, seeing that type of experience on a resume signals to me that I should give it another look," he said. "It indicates that they're interested enough in their profession to get relevant experience, and it shows that they've had the opportunity to see how a business works."

Other potential benefits for students are increased confidence and decreased training time when they do take permanent positions, Mahoney said. Having student employees is beneficial to the company, as well.

"First, we benefit from having students do some of the more basic projects for us because it frees up our full-time people for major projects," Mahoney said.

"Second, it's a chance for us to have a different, fresh set of eyes looking at our operation. Third, one of the bigger benefits is to see how prospective engineers are going to perform. If we see how they react to

real-world experiences, we can see if they are good prospects for full-time jobs with us."

While Aerostar, a wholly-owned subsidiary of Raven, does not have a formal internship program, the company does hire students for summer or temporary work. Senior mechanical engineering major David Pullen worked for Aerostar full time from May to November 1995.

During that time, Pullen designed and tested blower systems to inflate balloons, but his major responsibility was testing a first article prototype of a multi-spectral ground decoy system Aerostar developed for the government. The system included inflatable, life-size models of fuel trucks and F-16 aircraft.

Pullen performed a variety of tests on the models. He examined them to verify that their visual characteristics exactly matched the government's specifications. Through physical and environmental testing, he determined whether they would stand up to various conditions, such as rain or snow.

The pressure to complete such tasks taught him to be resourceful, Pullen said. "You definitely learn things you can't pick up in the classroom," he said. "If you need to build a blower from ground zero, you first have to decide, where do you start? Everybody at Aerostar gave me a lot of help as far as letting me know where to look for information."

Many students take routine summer jobs, but those, like Pullen, who find positions related to their majors gain more from the experience, said Larry Manderscheid, vice president of sales at Aerostar. Pullen's job forced him to draw on his engineering background to move through all the stages of a complex project.

"He had to figure out how to do the tests, then perform them, monitor them in detail, calculate the results and write them up," Manderscheid said. "When you work through a task from start to finish like that, I think it gives you great job satisfaction."

Pullen also gained perspective on the day-to-day demands of industry, which he will value when he takes a permanent position, Manderscheid said. "You can study and read your college texts and do well, but you're still going to get a reality check when you get out in the real world."



# EERC does GIS projects for Aberdeen, Sioux Falls

*Now that the City of Aberdeen has that information, they can use it to determine conflicts between wetland inventories that have delayed development projects. Drained wetlands will be targeted for restoration to improve flood control.*

The Office of Remote Sensing in SDSU's Engineering and Environmental Research Center (EERC) is involved with projects that will benefit two South Dakota cities. The projects, for Aberdeen and Sioux Falls, both involve the use of Geographic Information Systems (GIS).

A GIS is a merger of maps and databases that allows for complex analysis of geographic data. The connection, through GIS, of areas, lines or points on a map with database information makes them "smart," said Mary O'Neill, research associate and associate program director for the EERC.

O'Neill, along with Dave German, research associate for the Water Resources Institute, and Russ Rykhus, graduate geography student, recently completed a wetlands identification project for the City of Aberdeen. The project involved mapping all of the wetlands, including drained wetlands, in an area around the city as delineated by two different systems, the U.S. Fish and Wildlife Service's National Wetlands Inventory (NWI) and the U.S. Department of Agriculture's Natural Resource Conservation Service (NRCS).

The researchers retrieved the NWI data from the Internet and converted its format to that of ARC/INFO, a type of GIS software. They also used GIS software to digitize the NRCS data and to process both sets of information.

O'Neill, German and Rykhus overlaid the two sets of wetland data to create three categories of information: wetlands on NWI only, wetlands on NRCS only and wetlands on both. They then produced a map showing the location and number of hectares/acres of wetlands according to each of the three categories.

Now that the City of Aberdeen has that information, O'Neill said, they can use it to determine conflicts between wetland inventories that have delayed development projects. Drained wetlands will be targeted for restoration to improve flood control.

"There are rules and regulations as to what you can and can't do with a wetland, and how you define a wetland has been the subject of discussion for some time," she said. "Aberdeen now has information from both systems to aid them in making their development

and flood control decisions. They can see where conflicts between the NRCS and NWI inventories may cause problems."

O'Neill is also working with Janet Gritzner, associate professor of geography at SDSU, on a GIS project for the City of Sioux Falls. The two are collaborating with the city's Engineering Department and the South Dakota Department of Transportation (DOT) to convert the city's data on traffic counts and accident reports to ARC/INFO format. So far, Gritzner and O'Neill have investigated a GIS technique called dynamic segmentation for processing the traffic volume counts maintained by the DOT and by the Sioux Falls Engineering Department. Dynamic segmentation is an advanced feature of ARC/INFO designed specifically for data collected using a route measure system.

The two are also currently testing a method for converting the city's accident data. The state DOT presently uses a grid system for each county, which Gritzner and O'Neill hope to make compatible with the GIS presently in place for the City of Sioux Falls.

"If we can come up with something workable for Sioux Falls, DOT has a vital interest in it," O'Neill said. "They're investigating the possibility of converting to the ARC/INFO system statewide."

Converting the data to an ARC/INFO-compatible format will allow the City of Sioux Falls to analyze traffic and accident data quickly and efficiently, O'Neill said.

"There are probably a lot of ways to do this kind of thing," she said. "We've suggested one way. Whether the city actually chooses to go this direction, we don't know at this point."

Both projects are funded via contracts with the cities involved. The City of Aberdeen had funding assistance from the U.S. Environmental Protection Agency's non-point source program.

# Mission to Planet Earth proposes ways to benefit Upper Midwest

With the help of the Upper Midwest Aerospace Consortium (UMAC), farmers, school children and many more in the Upper Midwest could begin benefiting from space-based information in ways never before realized.

SDSU and seven other universities in the Dakotas, Montana, Wyoming and Idaho have been invited as members of the Upper Midwest Aerospace Consortium (UMAC) to plan activities that will make space-based information available and usable by people outside the traditional academic research community. The planned activities will also help NASA become more visible in the five-state region.

Currently, UMAC is in a six-month planning stage, funded by a \$300,000 NASA grant. George Seielstad of the University of North Dakota Center for Aerospace Sciences is the principal investigator of the current UMAC planning grant.

UMAC integrates different sectors, government, academic and business; different disciplines, all those that constitute earth system science; and different universities. The driving force behind the creation of UMAC is NASA's project, Mission To Planet Earth, which promises to enhance understanding of the global environment and detect changes the environment might be experiencing.

"UMAC has three main themes: agriculture, education and natural resources," said Kevin Dalsted, associate research soil scientist with the SDSU Engineering and Environmental Research Center (EERC). Each theme is associated with a Public Access Resource Center (PARC).

SDSU is presently involved with the planning activities of two of the PARCs — agriculture and K-12 Education. Dalsted is working with Gregg Carlson, SDSU extension specialist and professor of plant science, on Precision (or site-specific) Agriculture for the Ag PARC. Mary O'Neill, SDSU research associate and associate program director for EERC, is collaborating on K-12 Education for the Ed PARC.

In Precision Agriculture, the use of Global Positioning Systems (GPS) will help farmers increase crop yields. For example, a yield monitor attached to a combine can give site-specific yield readings as the combine moves across

the field, Dalsted said. These data are used to create a yield map which will help farmers fine tune their management to get the most production out of the field. With GPS technology, farmers can use specialized equipment to vary fertilizer application and planting rates in different parts of the field. Remote sensing products can be used to locate weeds and indicate where herbicide should be applied.

"We think remote sensing products will help make money for the farmer and help economic development in the Upper Midwest," Dalsted said.

Another important aspect of PARC is providing opportunities for students in sparsely populated areas to participate fully and meaningfully in the new discoveries and new ways of thinking about earth.

"I like the idea of taking data that in the past was considered only useful for scientists and making it available to a broad spectrum of everyday people, especially to students," O'Neill said.

Other South Dakota educators and schools collaborating on the K-12 Education PARC are John Keill of Washington High School in Sioux Falls, Linda Allen of the South Dakota School of Mines and Technology in Rapid City and Joe Hillberry of the Douglas school system.

These South Dakota educators will collaborate with other PARC educators on proposals for space-based activities that could be developed and distributed to schools through Internet. One activity being considered is tracking wildlife migration using student wildlife and weather observations shared via Internet and remote sensing satellite imagery of the migration routes. Software, easy for students and teachers to use for these activities, would need to be developed, O'Neill said.

O'Neill and Dalsted said the proposal for NASA funding of a five-year UMAC PARC project is scheduled to be submitted in April.



Mary O'Neill



Kevin Dalsted

# Welding program

*creates opportunities,  
helps industry*

**D**iane Herbranson may never travel to Shanghai, China, but a product she created did.

Herbranson graduated in December 1994 from a welder training program through the SDSU General Engineering Department. Now she works at Twin City Fan and Blower Company in Brookings, where she welds blowers that are shipped all over the world.

The program was started in late 1994 to help satisfy a local industry need for welders. The 80-hour program is funded by the Job Partnership Training Act for qualifying students. Qualifications are based on mechanical aptitude and interest; a high school diploma or GED is required.

"There is an absolutely insatiable appetite for these welders," said Roger Svec, SDSU general engineering instructor. "The program is going very well and will continue as long as there's a need."

The last class was taught over the Christmas break. Another will be held later this spring. Herbranson has returned to speak to every class since she graduated.

"She comes back and tells the students what they'll need for tools," Svec said. "She assures them that the employers and other employees will help them even if they are inexperienced."

Herbranson was inexperienced when she started at Twin City Fan. She was also the first female welder the company ever had in the Brookings plant.

"I was scared at first, but the guys here are easy to work with," she said. "There are secrets and tricks to things, but you have to ask them or they'll assume you know what you're doing."

Herbranson enjoyed the SDSU program and the follow-up she's had since. "If it hadn't been for this program, I wouldn't have tried welding

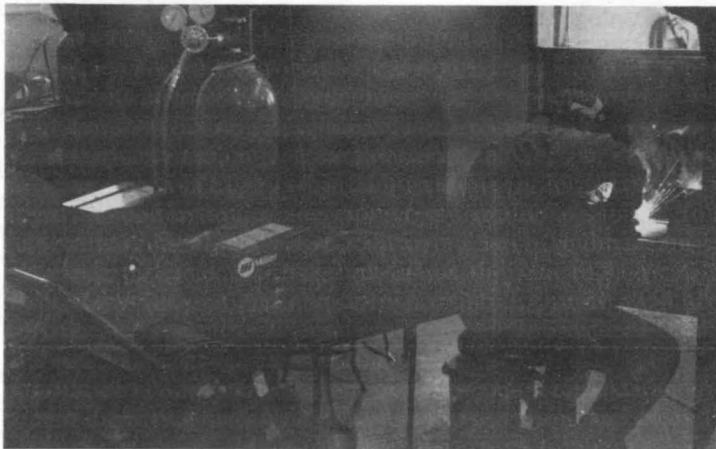
helped me try to figure it out."

Herbranson's supervisor, Rod Poppe, knows the first-hand benefits of the program.

"Diane is a very good welder," Poppe said. "She's dependable and has picked things up pretty fast. Other

welders we have hired from the program have been good, too. Roger is a good teacher. I know because he taught me."

The program was made possible through the Brookings Area Development Corporation, the Career Learning



and I would have missed out on the best job I ever had," she said.

"Roger and Harvey (Svec, both general engineering instructors) are very helpful. If I had a welding problem, I went back and talked to them and they

Center, Job Service, local industry and SDSU.

For more information, contact Jane Kono at the Career Learning Center, (605) 688-4370.

## Waste reduction now part of SDSU industrial program

**S**howing companies how to save money and help the environment at the same time is the job of employees of the Industrial Assessment Center Program at SDSU.

SDSU recently received \$160,000 from the Department of Energy to fund the program for the 1996 fiscal year.

In its three-year existence, program employees have analyzed more than 50 companies and identified energy cost savings exceeding \$1.5 million. So far, about half of their recommendations have been implemented by the companies.

This year, the program will include waste minimization and pollution prevention reviews with its energy review.

"In many cases, the costs associated with waste are as great or greater than energy costs," said program director Kurt Bassett, assistant professor of mechanical engineering at SDSU. "In order to do a complete assessment, we need to see where waste

is generated and where it can be eliminated. We're not looking for violations, we're just trying to see where cost savings might be."

All information obtained and recommendations reported are kept confidential.

Environmental benefits will follow, Bassett said, with reduced emissions and less material taken to landfills. The assessments are conducted by graduate and undergraduate engineering students and supervised by engineering faculty members.

"The experience gained is invaluable to both the students and their future employers," Bassett said. "Of the seven graduates who have been employed by the program, six accepted job offers which were the direct result of the experience they gained in the program."

Large businesses and industries in South Dakota, southern Minnesota, southeast North Dakota and Sioux City, Iowa, can apply for assessments by contacting Bassett at (605) 688-4817.

## Professor returns to NASA

When you go outside and breathe clean air, you can, in part, thank Madeleine Andrawis and her NASA colleagues.

During a summer fellowship program offered by NASA, Andrawis, assistant professor of electrical engineering, studied ways to improve how ozone is measured.

This was the second summer Andrawis participated in the NASA Langley Research Center American Society for Engineering Education Faculty Fellowship program. She was one of 54 faculty members selected from across the nation.

Andrawis' research focused on expanding the range of NASA equipment so it could better measure ozone.

"Depending on where ozone resides, it is either good for people or bad for them," she said. "If it is high in the atmosphere, it protects us from the sun's rays. If it is closer to the ground, it is harmful to breathe since it causes damage to people's lungs."

At NASA, laser beams are emitted into the atmosphere to measure the ozone. The backscattered laser energy is collected by a telescope and measured using photon counting systems for small components of light.

"The purpose of the research is to find where holes exist in the ozone layer and how thick the ozone layer is," Andrawis said. "NASA's Atmospheric Sciences Division is concerned about the environment and protecting life on earth."

The fellowship program encourages professors to relate their research findings to their classes. Andrawis has enjoyed her opportunities to share.

"Last year when I presented my research work with NASA, students got excited about engineering and about NASA's role in research," she said. "Because of some of the contacts I've made with women engineers at NASA, I hope I can encourage a few of them to come to SDSU and participate in our career guidance and outreach programs."

Andrawis will use a NASA videotape series about different aspects of engineering in presentations and lectures to a wide range of age groups, middle school

students through adults, to recruit and retain students.

She will apply for a NASA fellowship next summer to continue her research.



## Professor edits international journal

Standing as one of the world's best sensor research institutions was enhanced by a recent publication. Lewis Brown, associate professor and acting head of the Electrical Engineering Department, was the head guest editor for a recently published special issue of the international journal "Ferroelectrics."

Among the devices ferroelectric polymers are used to create are electronic sensors for hearing aids, medical ultrasonic imaging systems and security system motion detectors.

These ferroelectric polymers were discovered in 1969 by a Japanese researcher.

"His discovery opened a whole new area of science," Brown said. "I know the chief editor of 'Ferroelectrics,' and two years ago I asked him if he was doing anything special for the 25th anniversary. He thought a special edition would be a good idea and he asked me to be the head guest editor."

The 403-page edition included papers submitted from the world's leading ferroelectric polymer scientists and took nearly two years to complete. Brown was responsible for soliciting contributions, reviewing the papers, laying out the journal and corresponding with the editor and publisher. He was assisted by two other polymer scientists, Francois Bauer of France and Eichii Fukada of Japan.

"It's an excellent summary of the first 25 years in this field, both in theory and in application," Brown said. "I consider it a real milestone as a scientist."

SDSU will also gain from the publication.

"One of the benefits I've had from my involvement in the journal is the tremendous number of contacts from scientists and companies all around the world that are interested in this technology," Brown said. "I'm in the process of developing many new connections and opportunities for SDSU."

The University is already well-known in the international community for its research in this area. The most significant contribution so far was presented at an international ultrasonics symposium this fall in Seattle.

"We were the first scientists to report test results from the new ferroelectric nylon materials being developed at Rutgers University," Brown said. SDSU and Rutgers have been collaborating on these new sensor materials since 1992. "We were the first to build sensor devices with these materials and characterize them. Some scientists wait their whole lives to be the first to do something like this."

Joel Mason, a senior electrical engineering major, worked closely with Brown to conduct this research.

In the special issue, Brown and two Rutgers scientists published a paper about this research entitled "High Frequency Dielectric and Electromechanical Properties of Ferroelectric Nylon 11." Brown is also associate editor of another international journal, "The IEEE Transactions on Ultrasonics, Ferroelectrics and Frequency Control."

## Students important to new faculty members

A concern for students links two new faculty members in the SDSU College of Engineering. Francis Ting, associate professor of civil engineering, and Ross Wilcoxon, instructor of mechanical engineering, want to help students prepare for their future careers.

Ting has submitted a proposal to the National Science Foundation to upgrade the fluid mechanics laboratory.

"There is a serious shortage of modern equipment," he said. "We don't even have a computer in the lab. If undergraduates aren't exposed to modern equipment in this technical world, it puts them at a serious disadvantage."

Because Wilcoxon was a B student, he understands the students' learning perspective.

"It makes me a better teacher because I know I need to find ways to motivate them," he said. "Things didn't always come easy to me, so I understand how they may have problems with some concepts."

Wilcoxon had examples of engineering demonstrated to him while growing up on a farm near Slayton, Minn.

"Dad would create some Rube Goldberg contraptions that worked," he said. "He didn't have the training, just the intuition."

This background means Wilcoxon likes to see physical solutions to abstract problems in his classes,

Dynamics, Vibrations and Aerodynamics.

"For example, in vibrations class I might bring in some kind of gadget to tell them the equations, then demonstrate the concepts," he said. "My need to see applications from concepts means I bring that to the classroom."

Ting teaches Fluid Mechanics, Environmental Fluid Mechanics and the labs that go with them. He was born in Hong Kong and went to boarding school in England. After earning his bachelor's degree in civil engineering from the University of Manchester in England, he came to the United States and received his master's and doctoral degrees from the California Institute of Technology.

"I like the opportunity for research in the United States," Ting said. "This country has more opportunity and financial backing for research than many other countries."

Ting's previous research as a post-doctoral research fellow at the University of Delaware and assistant professor at Texas A&M University focused on fluid turbulence. One project centered on the dynamics of turbulence in the surf zone, which is a major cause of beach erosion.

He's applied for a grant to study bridge scour, erosion around bridge foundations in rivers and streams.

"We want to conduct a laboratory study of the flow around obstructions like bridge piers and abutments," Ting

said. "We'll look at the effect of turbulence on soil erosion. It's a poorly understood area, especially in cohesive soils."

Wilcoxon's research interests involve flow-induced vibrations.

"One example would be that the flow of air past a chimney can cause the chimney to vibrate," he said. "You could

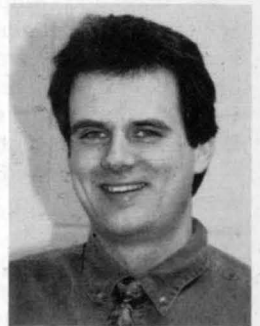
change the chimney to modify the flow and eliminate the vibrations. In the past, there was a tendency to separate problems into fluid mechanics and vibrations. This way is a combination of the two."

Wilcoxon earned his bachelor's and master's degrees in mechanical engineering from SDSU. He is completing his dissertation for his doctorate in mechanical engineering at the University of Minnesota.

He and his wife, Carolyn, live in Brookings with their children, Jacob, 19 months, and Margaret, three months.



Francis Ting



Ross Wilcoxon

## SDSU co-hosts Regional Agricultural Engineering Conference

More than 125 agricultural engineers from the Dakotas and Canada gathered in Brookings for the American/Canadian Society of Agricultural Engineering North Central Section Conference Sept. 28 and 29.

The conference, hosted by SDSU and South Dakota agricultural engineers, included more than 30 technical presentations in six sessions. Topics included soil conservation, irrigation, water quality, food and crops processing and farm automation.

A conference highlight was contest wherein students designed a power take-off shaft out of biological materials, including hot dogs, toothpicks, spaghetti and cotton thread.

"It was an opportunity for students to apply engineering fundamentals to a not-so-serious problem," said Dan Humburg, assistant professor of agricultural engineering. "It really combined engineering and entertainment."

Tours were given of SDSU Agricultural Engineering research facilities. A banquet featured motivational speaker V.J. Smith of Brookings.

## IBM speaker/SDSU student discuss communications in engineering

**T**eamwork and communication are as important to engineers as math and computer designs. SDSU electrical engineering students heard this message from IBM development engineer/manager Chris Goetschel and SDSU student Ryan Danielsen, an IBM intern.

IBM has changed in the past few years, Goetschel said, and has become more market-driven.

"If you don't get your products out on time, someone else will and you won't get the sales," he said. "Engineering is about estimating, about making the right assumptions because you can't analyze everything down to the atom."

The Rochester, Minn., IBM department where Goetschel and Danielsen work makes analog, mixed-signal and integrated computer chips. Engineers start with the customer's functional requirements, which change often in the few months the project

takes to complete.

"Customers know what they want when they see it, but they don't always know how to tell you to get there," Goetschel said.

"Engineers need to keep in contact with customers in case their needs change during the project."

Time management is also important. If engineers underestimate how long a project will take, Goetschel said, they won't be able to deliver as promised. But if they overestimate the time, the cost estimate will be too high and the client will go elsewhere.

Since Danielsen began his internship last summer, he saw the problems design engineers face. "There has to be a balance between a perfect design and the design that can be done when marketing needs it to be



*Chris Goetschel, development engineer and manager at IBM in Rochester, Minn., talks to SDSU electrical engineering student Donald Janvrin when Goetschel came to SDSU to discuss engineering communication.*

done. When you send a chip to be made, you can't be 100 percent sure it will work, even if you've tested it. You have to go by previous experience."

Danielsen also learned about communication.

"You have to get to know the people around you and learn from them," he said. "People make changes quickly, so you need to know what's going on. You can't work in your own little pod."

An electrical engineering/computer science double major, Danielsen plans to return to SDSU this spring and graduate in spring 1997.

## SWE takes young women down 'The Road Less Traveled'

**B**rookings middle and high school students engineered their way down a road less traveled, thanks to members of the SDSU Chapter of the Society of Women Engineers and alumna Joan Trygstad.

SWE students planned, sponsored and presented "Discover Engineering: The Road Less Traveled," a national teleconference designed to encourage young people, especially women, to pursue engineering careers. The live, interactive teleconference was designed by National Technological University in Fort Collins, Colo.



After the hour-long program, which SDSU accessed from its Rural Development Telecommunications Network classroom, a panel discussion was led by SWE officers and SWE advisor Madeleine Andrawis, assistant professor of electrical engineering.

Funds provided by SDSU engineering alumna Joan Trygstad covered the teleconference tab, which included the downlink cost and lunch — pizza, pop and cookies — for the 19 participants, including a middle school and a high school teacher.

*SWE officers and advisor Madeleine Andrawis lead a panel discussion during a national teleconference for area middle and high school students.*

# Space Grant students launch high-altitude balloon

*The balloon reached a cruising altitude of 95,000 feet and the payload was recovered with no damage 10 miles north of LaCrosse, Wis.*

Engineering students from SDSU and the South Dakota School of Mines & Technology launched a high-altitude research balloon from the Mitchell Airport at 8:30 a.m. Oct. 21. The payload held student designed and built communications projects, tracking and control instrumentation and a video camera system.

"The flight was successful overall," said Andy Giddings, SDSU project coordinator. "The communications and video camera functioned within specifications, but we still need improvement in our tracking and control instrumentation."

The balloon reached a cruising altitude of 95,000 feet and the payload was recovered with no damage 10 miles north of LaCrosse, Wis. Members of the South Dakota Civil Air Patrol and amateur radio operators tracked the balloon from different ground sites throughout the region.

The next balloon launch, scheduled for April in the Black Hills, will include an experiment by SDSU mechanical engineering seniors Chris Benning of Madison and Jerad Whitaker of Brookings. The two are developing a particulate sampler that will expose filters at different altitudes and measure what particles and pollutants are present.

Omer Durfee, SDSU graduate research assistant for the balloon project, is project coordinator for high



school and middle school science projects for the April launch.

"My main goal is to assist secondary school science and math programs in developing experiments for the high-altitude balloon," Durfee said. "This allows secondary school participation with university and industry science programs."

The balloon project, started in 1993 as a cooperative effort between SDSU, South Dakota Tech and the EROS Data Center, is sponsored by the South Dakota Space Grant Consortium with funding from NASA and the South Dakota Future Fund. Raven

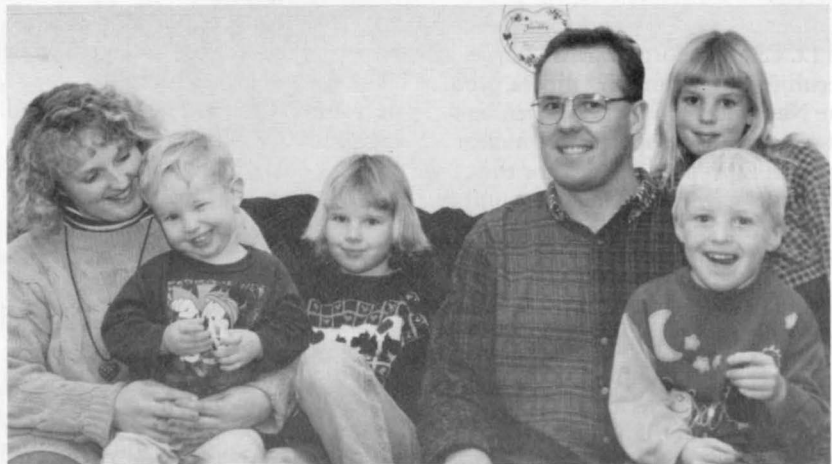
Industries and Hughes STX, both of Sioux Falls, and Horizons Inc. in Rapid City are industrial affiliates.

Several businesses and people made the October launch possible. Raven Industries' Aerostar Division donated the balloon and many Raven employees provided technical assistance. The payload package was assembled at the

hangar of the Soukup & Thomas International Balloon & Airship Museum in Mitchell. Brookings Telephone provided cellular phones and the Mitchell National Guard provided housing for balloon launch personnel.

*SDSU engineering graduate student Andy Giddings and senior engineering students Chris Benning of Madison and Jerad Whitaker of Brookings examine the payload of the high-altitude research balloon SDSU launched with the South Dakota School of Mines and Technology.*

## Curtis Jensen, nontraditional student



Nontraditional Student Association President Curtis Jensen gave up farming in 1994 to pursue his mechanical engineering degree. He and his wife, Leisa, a pre-nursing student, are shown with their children: Cristopher, 2, Charlotte, 9, Nicholas, 6, and Elizabeth, 10.

## Nuclear aspect of Navy appeals to SDSU grads

Even in land-locked South Dakota, students are interested in the Navy. Two SDSU December graduates are involved in nuclear power-related ventures for the Navy.

Mechanical engineer Jeff Nesheim will be a nuclear propulsion officer. Nuclear-trained officers fill most officer assignments on the Navy's nuclear submarines and aircraft carriers.

Tom Brandenburger, a mathematics master's degree graduate, will be an instructor at the Nuclear Power School in Orlando, Fla. Those instructors provide all Navy nuclear-trained people with the academic foundation they need when they become responsible for the safe operation of the Navy's nuclear propulsion systems.

Nesheim was sworn in as an officer candidate after passing several interviews. During his last year at SDSU, he was paid as a petty officer third class.

"They paid me to go to school," he said. "My orders were to not get a C or lower in technical classes, keep my grade point average above 3.2 and pass a physical readiness test."

"Since Jeff joined the program, he has received more than \$1,500 per month and a \$4,000 signing bonus," said Lt. Cmdr. George Curtiss, Navy Recruiting Command in Omaha, Neb. "The Navy wants only the best leaders and technicians to operate its nuclear ships and is prepared to pay for the best. SDSU gave Jeff the background to compete with other applicants from across the country and earn this job opportunity."

Nesheim started his 13-week Officer Candidate School in Pensacola, Fla., Jan. 8. After completing that, he will spend six months at the Nuclear Power School in Orlando, followed by six months in a nuclear prototype training unit, where he will learn how to operate a nuclear power plant. After four months in submarine school, he will be assigned his first sub as leader of a division of sailors.

Brandenburger signed up for the program in fall 1994 after seeing the Navy's 800 number (1-800-228-4036) on a poster. Following a series of applications and interviews, he was accepted in January 1995, after which he was paid more than \$1,500 a month.

"I went to Washington, D.C., for three interviews, two of which were technical," he said. "In one, they asked me to teach something. The final one was in front of the admiral, who is the head of the nuclear program. The Navy forms were very thorough; in one, I had to draw a map to my parents' farm."

Brandenburger began his six-week Officer Indoctrination School in Newport, R.I., Jan. 8. He will then move to the Nuclear Power School in Orlando, where he will teach courses like math, physics, chemistry and thermodynamics.

"The first group is officers who have graduated from college," he said. "The second group is enlisted personnel who have just come out of high school. I think there will be enough challenging aspects to keep me busy for four years."

"Tom joins an elite branch of the Navy," Curtiss said. "The best educated engineering and science students compete for these jobs. SDSU obviously prepared him to compete with the best in the country and be selected to join our nuclear power community."

After graduating from SDSU in 1992 with a degree in math education, Brandenburger taught junior high math for a year in Aberdeen. In 1993 he married Janice Adelman, a 1992 SDSU dietetics graduate.



Jeff Nesheim



Tom Brandenburger

## Students win at ACM contest site

Computer programming students were site winners of the ACM International College Programming contest at Briar Cliff College in Sioux City, Iowa, Nov. 4.

SDSU team members Jeff Hauck, Lora Spokowiak and Danielle Mentele won by solving two programming problems within the five-hour limit. Members of the second SDSU team were Rob Malo, Tony Siegel and Sam Adli. Team coach was Sung Yun Shin, assistant professor of computer science and Computer Club adviser. Shin also served as a judge at the contest.

The International ACM College Programming contest, held annually on the first Saturday of November, is sponsored by Microsoft. Approximately 1,000 schools participate at sites in Europe, Asia and the United States. The North Central Region has 60 to 70 teams from Minnesota, Wisconsin, South Dakota, North Dakota, Iowa, Nebraska and Kansas which compete at 20 sites within the region.

Two teams are chosen winners from each region and go on to compete in the final contest in March. The winner there will be honored as the best programmer in the world.

"SDSU students have always ranked high in the contest," Shin said. "We are proud of our students because they have taken SDSU computer programming classes and have learned how to solve problems quickly." Last year the SDSU team was site winner at Fargo, N.D.

SDSU Computer Club members paid for the expenses of sending the teams to the contest.



## World Wide Web helps SDSU students

Last semester Curt Jensen found the solutions to his engineering problems without leaving the comforts of home.

Jensen, a junior mechanical engineering major, took Eric Nielsen's Engineering Materials class at SDSU. Nielsen posted solutions for homework problems on the World Wide Web so students could access them and learn to use the Internet.

"Students always wonder what a problem they missed in an assignment was supposed to look like," Nielsen said. "I scan the solutions in at Computing Services so they can view it graphically."

It was much easier for Jensen to connect to the Internet at home in Brookings than to make copies of

solutions the traditional way.

"Every week Eric would post solutions, so instead of going to the office and making copies, I could just go to the solution I wanted, click on it and print," Jensen said. "Some instructors only will allow you to copy solutions by hand. I've spent over an hour copying before. This is much more efficient."

Sophomore mechanical engineering major Amy Lewis also used the Web to find her solutions. "I used the computers in the department and they were very user-friendly. I had never used the Internet before, so it was good experience."

Nielsen's students must use the Web to correct their homework, as he no longer posts solutions in his office.

Ross Wilcoxon, mechanical engineering instructor, also uses the Web for class. "I require my class to read an aeronautics news group, which can provide students more information than what I can give them. They can read through the topics and find what interests them. If they have questions, they have access to many experts."

As SDSU faculty members learn more about the Internet, they will use it to post notes, lectures, solutions and problems for easy access by students.

"I think it's important for engineers to be fluent on the Web because, in today's world, information is growing at an incredible rate," Jensen said. "With access to the Internet, you can get a lot of that information."

## Graduate engineering students receive \$6,000 ISHM grants

Pat Story and Kevin Vetelino, electrical engineering graduate students, each received a \$6,000 research grant from the International Society of Hybrid Microelectronics.

The students' adviser, assistant professor David Galipeau, said ISHM is prestigious and limits the number of its grants. "All of the major universities in the country have microelectronics programs, and ISHM only gave 11 awards this year," Galipeau said. "For SDSU to get two of the 11 awards speaks very highly of our program and our students."

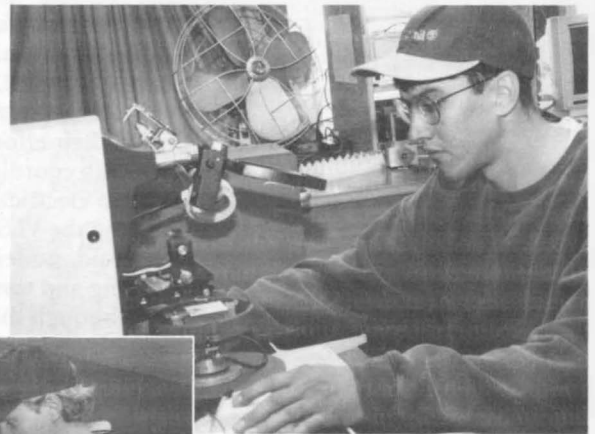
To win the grants, students submitted proposals detailing their research and its applications to industry. Their proposals were reviewed by a panel of professionals from universities and industries. Their decisions were based largely on the strength of the proposals, but also on the quality of the students and the facilities at their disposal, Galipeau said. Story and Vetelino will conduct their research using the latest technology available at SDSU. "One thing that strengthens their projects is

the fact that we have a state-of-the-art materials laboratory with \$150,000 in new equipment," Galipeau said.



Story and Vetelino have already published several papers each, putting them ahead of most master's level students, Galipeau said.

Story's grant proposal was entitled "A Hybrid Trace Gas Sensor." In his research, he will use a Surface Acoustic Wave (SAW) sensor to measure humidity levels less than 5 percent and hydrocarbon-based fuel vapors in the



parts per million range.

Vetelino's proposal was entitled, "A Surface Characterization Technique for Microelectronic Materials." His research will help the microelectronics industry understand their materials better, which in turn helps them in the fabrication of integrated circuits.

Story and Vetelino plan to graduate in May and will use their research findings in their master's theses.

*Second year electrical engineering students Pat Story, shown in above, left photo, and Kevin Vetelino, in above, right photo, won two of the 11 research grants awarded by ISHM this year.*

## SDSU offers students VLSI Lab experience



*Madeleine Andrawis is shown in the VLSI lab with former student Viji Ranganna, who currently works in the VLSI area at Meta-Software in San Jose, Calif.*

In a world of rapidly-changing technology, SDSU's College of Engineering is keeping up. In spring 1995, the Department of Electrical Engineering offered its first Very Large Scale Integration course using the VLSI lab. Currently worth about \$20,000, the lab enables students to learn and work with some of the latest digital design technology in the market.

The concept of VLSI is to integrate more circuit components into smaller chips with a faster productivity rate. Since it has become a recent national interest and not many universities offer it, SDSU continually receives

free software and hardware from industries in support of their efforts, said Madeleine Andrawis, lab coordinator and assistant professor in electrical engineering.

Because the VLSI technology is new, Andrawis said, students are learning to use it by designing and testing low-scale integration circuits. Although the tools are capable of handling big-scale projects, she said, the students have to first gain a "comfortable"

knowledge of VLSI.

Christian Geotschel, development engineer and manager at IBM in Rochester, Minn., lectured to SDSU engineering majors about VLSI circuit design and toured the lab last fall. "I think the VLSI Lab is an exciting opportunity for students to learn about circuit layout and have the means to test chips they design," he said. "We offer co-op positions for students with VLSI experience and we'll definitely consider SDSU students in the future."

Andrawis said it was exciting to see Geotschel so interested and pleased with the lab. "There are many job opportunities in VLSI," she said. "Students who acquire experience in this field significantly increase their chances of finding a job."

One firm from Minneapolis, LS! Logic, expressed an interest in SDSU students with VLSI experience. A company representative interviewed seniors and graduate students at SDSU's CAP Center last May.

The VLSI lab is funded in part through the New Ideas Fund from SDSU's Vice President's Office for Academic Affairs and the College of Engineering. Over half of VLSI software is donated by various industries: XILINX, producers of Field Programmable Gate Array (FPGA) chips; OrCAD, makers of circuit design automation software tools; and Tanner Research, creators of L-EDIT, a layout design editor.

## Software grant to help SDSU engineering students

*"For those students who use it, it will give them experience similar to what they may use in the working world," Twedt said.*

Engineering students working on design projects will find their jobs a little easier. The Education Foundation of the Society of Manufacturing Engineers (SME) awarded SDSU \$12,000 worth of software comprised of four Autodesk AutoCAD Designers, four AutoCAD Release 12 and four Autodesk Autosurf/Automill programs.

"AutoCAD is used by engineers to draw projects to scale," said Mike Twedt, SDSU mechanical engineering instructor. "These two packages build on AutoCAD and allow us to do more with it. Autosurf, for example, makes it possible to draw complex 3-D

surfaces for machining."

Students will be able to use the software for senior design projects, architectural drawings, computer graphics and other applied projects.

"For those students who use it, it will give them experience similar to what they may use in the working world," Twedt said. "Even those who don't use it benefit just by knowing what software is available to engineers."

SDSU recently started an SME student chapter. The international organization, headquartered in Dearborn, Mich., has more than 70,000 members in 70 countries.

# Scholarship established in memory of Brad Schultz

*“His ideas and beliefs were above reproach, and his creative and energetic manner made him fun to work with. He was truly loved by all. We think of him daily and the memories are fond.”*

The family members and former employer of Brad Schultz, a 1994 electrical engineering graduate who died while vacationing in Mexico last spring, have established a scholarship in his name.

Ed Cannon, president of Cannon Technologies of Plymouth, Minn., where Schultz worked, started the Bradley D. Schultz Memorial Fund with a \$5,000 gift. The Schultz family contributed \$9,000.

The money will form an endowment, with the interest used for the scholarship, said Lew Brown, associate professor and acting head of the SDSU Electrical Engineering Department.

The Department of Electrical Engineering will award the annual scholarship of \$500 to a junior or senior electrical engineering student who has a cumulative grade point average of 3.0 or higher and is interested in pursuing a career in power systems engineering or a related area. The remaining interest earnings will assist students who wish to travel to power systems related activities.

Cannon, a 1974 SDSU electrical engineering graduate, said all the employees of Cannon Technologies felt close to Schultz, even though he only worked there two months.

“His ideas and beliefs were above reproach, and his creative and energetic manner made him fun to work with. He was truly loved by all,” Cannon said. “We think of him daily and the memories are fond. In starting a scholarship fund, we hope to help other individuals who have the spirit and commitment that Brad possessed.”

As an added tribute, Brown requested that the family provide the Electrical

Engineering Department with a portrait of Schultz to hang in the senior design laboratory. Schultz spent countless hours in that laboratory, said Brown, who advised him on his senior design project.

“He just went above and beyond what’s expected of students on those projects,” Brown said. “I had a lot of fun working with him. He was just a big, husky, friendly, lovable kind of guy.”

Brown said Schultz especially admired Wayne Knabach, retired professor of electrical engineering, who instructed Schultz in several classes and accompanied him on field trips. The feeling was mutual, Knabach said.

“As I reflect back, something I always appreciated about Brad was his attitude and enthusiasm for whatever he was doing,” he said. “He was so easy to work with. He was an excellent student with a unique, special personality.”

Schultz’s parents, Ronald and Jeanne Schultz of Merrill, Iowa, are happy to be able to help others through the memorial fund. “It’s a fine tribute to Brad,” Jeanne Schultz said. “I’m pleased it’s something in power engineering, which was his area.”

“Brad really enjoyed SDSU and had a lot of friends there. He always talked highly of Mr. Knabach and those in the electrical engineering department. We are grateful that Mr. Cannon started this scholarship and we were able to contribute to it.”

Friends and alumni are encouraged to contribute to the Bradley D. Schultz Memorial Fund. For information, call the Department of Electrical Engineering at 605-688-4526.

## Paper presented at LA symposium

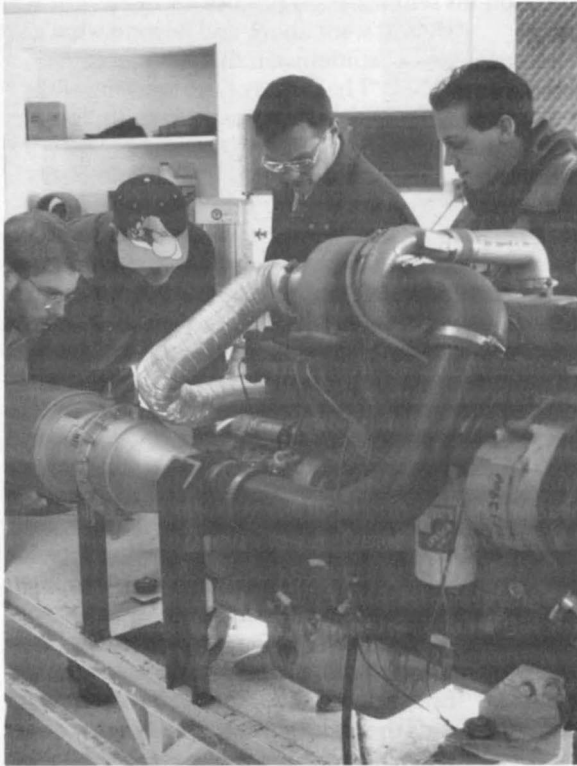
Kevin Vetelino, graduate assistant in electrical engineering, presented a paper “A Study of Thick Film Humidity Sensors Using Polymer and Thick Film Sensing Elements” at the International Symposium on Microelectronics Oct. 23-26 in Los Angeles. The paper was co-authored by Patrick Story, graduate assistant, Bryce

Declercq, research assistant, and Dr. David W. Galipeau, assistant professor of electrical engineering.

Also attending the symposium was Russell Milham.

A “Best Paper of Session Award” was received by all authors. In addition, a “Best Overall Student Display Award” was received by the student attendees.

# Donation of Cummins Engine provides learning experiences



*Senior mechanical engineering majors Robert Lutz, Brent Jordan, John Lehman and Chuck Lehn examine the diesel engine donated by SDSU alumnus Mike Beyer of Cummins Engine Corp.*

A diesel engine donated by an alumnus of the Mechanical Engineering Department is providing learning experiences for students now and into the future.

Mike Beyer, a 1990 SDSU graduate, is now a senior engineer in Noise and Vibration for Cummins Engine Corp. of Columbus, Ind. When the company was faced with the choice of destroying an experimental engine or donating it to a non-profit organization, he thought of his alma mater.

"It's so much better to donate it to an educational institution," Beyer said. "The students can use it to gain some knowledge about the simple workings of an internal combustion engine, as well as get some hands-on experience in how to document its performance."

Last fall, a senior design team began working to make the engine useable, said Don Froehlich, head of the Mechanical Engineering Department. "It plays a dual role for us," he said. "They will use it to complete their senior design project, and then we can turn around and use it in an instructional setting."

Brent Jordan, John Lehman, Chuck Lehn and Robert Lutz make up the team, which spent last semester locating and mounting equipment and getting the engine running. They are especially grateful to Dan Renaud, regional service manager at Case IH in Bloomington, Minn., for donating a radiator, Jordan said.

The team has had assistance from

Harvey Svec, instructor of general engineering, and Jason Sternhagen, sophomore mechanical engineering major, in welding and mounting the engine. Dan Friedrich, technician, and Todd Vanderlinde, sophomore mechanical engineering major, are helping the team connect a computer to the engine for data collection.

This spring, the team will mount and program data acquisition equipment to measure temperature, pressure, air flow, horsepower, specific fuel consumption, torque and efficiencies, Jordan said. They will present the engine at the Senior Design Conference and Engineering Exploration Days in April.

In the future, Jordan said, students at several levels will be able to use the engine in classes. For instance, senior design students could measure the pressure inside the cylinder as the engine is running.

"This will give students in future semesters a chance to do experiments and get a better feel for the thermodynamic properties of the engine under load," he said. "This engine is used in so many places that understanding it will really prepare them for industry."

Those educational opportunities would not be possible without Beyer's donation, Froehlich said. "If we were to have to purchase that equipment, it would be very expensive," he said. "It is a great opportunity for us because we definitely will use the engine in our classes."

Cuts in federal and state education funding make it necessary for private industry to help prepare students through donating equipment and expertise, Beyer said.

"To me, education is the heartbeat of America," he said. "It is the future. If we want to continue to compete and be a technical leader in the world, that is the last place we need to cut."

## Hobbach to establish chair in engineering

An electrical engineer from South Dakota State who made his living as a California patent attorney plans to establish a chair in engineering at SDSU.

Harold C. Hobbach of Atherton, Calif., a 1944 graduate, thinks electrical engineering is a "great field ... there are lots of branches to it. It's a field that you can do as well in South Dakota as anywhere." In fact, he said, "South Dakota needs to do more to encourage industry in the state to hire engineers" because such is the way of technical innovation.

He foresees that one day the "Hobbach Professor" in electrical engineering can have an impact on the way the field is practiced in the state.

SDSU Dean of Engineering Duane Sander thinks Hobbach could be right. "Harold Hobbach has been a technical pioneer his whole working life. We are grateful for his interest in helping improve engineering instruction and research and also statewide industrial development."

Hobbach is a senior partner in the law firm of Flehr, Hobbach, Test, Albritton and Herbert, which specializes in patents, trademarks and copyrights. Formerly in its San Francisco office, Hobbach now maintains an office in the firm's facility in Palo Alto, neighbor to some of the best-known technology manufacturing firms in the country.

He still has relatives in the Plankinton, S.D., area, however, and returns to the state from time to time. "I do feel a loyalty and obligation to help South Dakota if I can," he said.

Hobbach's career choice, even his attendance at State, was not exactly by design, however. "My uncle, A.C. Miller, was South Dakota lieutenant governor at the time I left high school. In the fall, he just kind of picked me up from the farm job I had, drove me to Brookings and dropped me off." With a bent for technical subjects, Hobbach found himself suited for study in engineering.

These were war years, though, and



*"Harold Hobbach has been a technical pioneer his whole working life," Sander said. "We are grateful for his interest in helping improve engineering instruction and research and also statewide industrial development."*

*Dean of Engineering Duane Sander*

campus life was not necessarily typical. "My class would have graduated in the spring of 1944," Hobbach recalled. "But the school had a special, hurry-up graduation ceremony right at the end of '43 so that most of us men could leave for military service."

Hobbach's war was spent in the signal corps, including a stint in Casablanca, and he learned to like the weather in that part of Africa. After the war, he and an Army buddy headed for California to go to graduate school because they'd heard that California's weather was akin to Casablanca's.

Hobbach earned a business degree at the University of California at Berkeley, then signed on for law school at the same institution. With his undergraduate training in electrical engineering, patent law seemed a natural specialty in 1952, putting him on hand and in position to experience the explosion of technical invention that would occur in what became known as Silicon Valley.

Was Hobbach's firm in the thick of the action? Let's put it this way: Hobbach's partner, Paul Flehr, helped Hewlett-Packard get its very first patent. And that company's had a few since. Hobbach authored the foreword in Flehr's 1990 book "Inventors and Their Inventions," which chronicles the people and ideas that made California a hotbed of invention and technological activity.

Hobbach himself estimates he has helped clients obtain hundreds of patents. As an electrical engineer, he's felt very comfortable in working with people in the semiconductor industry. He acknowledges having done some work over a number of years for fellow SDSU grad and fellow Atherton resident Gene Amdahl.

Hobbach's South Dakota farm background has been useful in being able to assist California inventors of farm machinery.

Medical devices have been another area of interest. Hobbach was part of the early development, for example, of balloon angioplasty equipment.

One long-time Hobbach client, Dr. Forrest Bird, who invented the first medical respirator, was recently inducted into the National Inventors Hall of Fame.

Bringing products to fruition to help people — even to save their lives — makes the patent field very rewarding, Hobbach said.

Knowing the Northern California technology company scene as well as he does, Hobbach has chosen to invest in technical firms and even a number of start-up companies ("Nine out of 10 of those don't do well," he smiles.) He has made gifts of technology stocks valued at approximately \$150,000 so far and plans to build toward funding the Hobbach Professorship in that fashion. He also has the program named in his will.

Hobbach's gifts are targeted to the teaching and research portion of the Visions for the Future project at SDSU. He and his wife, Marilyn, a Stanford alumna, have four children and seven grandchildren.

## Herther family, friends establish scholarship

**F**amily and friends of LeRoy Herther, an SDSU civil engineering graduate with a long record of career accomplishments, have established a scholarship in his name.

The LeRoy Herther Scholarship in Engineering will go to a junior or senior engineering student who demonstrates financial need but does not qualify for federal financial grants. Duane Sander, dean of the College of Engineering, said he hopes the scholarship will encourage recipients to keep working hard in school.

"This distribution mechanism that emphasizes financial need and the practical ability of the student not only provides critical monetary support for tuition, fees and books, but also provides encouragement for those students who receive the award to complete their degree program," he said.

Herther's accomplishments should be an inspiration to engineering students, Sander said. "The scholarship also emphasizes the very successful career of Mr. Herther, who is an excellent example and role model to which our students can aspire."

One of Herther's three daughters first suggested the scholarship, said Herther's wife,

Kay. Her husband had good memories of SDSU and used his education well, she said. "This is a tribute to him."

LeRoy Herther, a Hecla native, earned his bachelor's degree in civil engineering from SDSU in 1934. After graduation, he worked as an engineer with the CCC Camp at the Sand Lake National Wildlife Refuge in Columbia and the superintendent of the CCC Camp in Martin. Upon joining the U.S. Geological Survey, he moved to Washington, D.C., to do topography mapping for the Military Department of Geology during World War II.

Herther married Kay Robinette in 1943. Three years later, they moved to Hecla to run the Herther Mercantile Store. The couple were also community leaders responsible for numerous school and civic improvements.

In 1956 Herther took a position with the State Highway Department and moved with his family to Pierre, where he eventually became the department head for Secondary Roads. After retiring at age 69, he consulted for a private firm. He and his wife moved to Rapid City in 1990.

LeRoy Herther passed away Aug. 10, 1995.

## Electrical Engineering Department receives equipment grant

**A** state-of-the-art machine will help senior electrical engineering students at South Dakota State University examine power systems more quickly.

The South Dakota Electrical Council donated \$900 to the SDSU Electrical Engineering Department to purchase a Fluke41 power system analyzer. The Fluke41 is a hand-held multimeter/oscilloscope which will be used by energy conversion and senior design students to analyze AC machines and electric power devices.

"It is very convenient for helping students to quickly assess the power quality of a system they're studying, which is something they didn't have before," said Steve Hietpas, assistant professor of electrical engineering. "At the same time, they're being exposed to state-of-the-art instrumentation."

The analyzer is capable of measuring and



*Steve Hietpas, assistant professor of electrical engineering, accepts a check from Wayne Knabach South Dakota Electrical Council board member. The \$900 was used by the SDSU Electrical Engineering Department to purchase a Fluke41 power system analyzer.*

displaying voltage, current and power for a single-phase circuit and can display in time domain or frequency domain.

## Large private donation enables update of electrical engineering lab

Two \$10,000 annual gifts to the Donald and Nancy Haselhorst Engineering Equipment Fund have helped the Department of Electrical Engineering to completely upgrade the equipment in one instructional laboratory, said Lewis Brown, assistant professor and acting department head.

Along with \$5,000 in gifts from alumni contacted during the annual Engineering Week Phonathon, the Haselhorst donation gives electrical engineering students the opportunity to work with the latest in testing equipment in the electronics and circuits laboratory, Brown said.

A Northville native, Donald Haselhorst graduated from SDSU in 1956 with a major in electrical engineering and went on to serve as chairman of the board of Nicolet Instrument Corp. He died in 1984 after generously supporting SDSU engineering for several years, Brown said.

Haselhorst once told the late Ernest Buckley, former dean of the College of Engineering, that he wanted to help create an engineering

laboratory, said Jeff Nelson, director of planned giving for the SDSU Foundation. "He was very sensitive to the needs of higher education," Nelson said. "His wife Nancy has taken up the cause and shared her resources toward the kind of projects he was interested in."

The Haselhorsts were married while Donald was still in school, and the newlyweds lived in married student housing, Nancy Haselhorst said. "I've got a lot of good memories of Brookings," she said. "It was a very special place. Don always felt that SDSU was very good to him and that the schooling he got was excellent. He wanted to help other students and keep the engineering program up-to-date."

Through their gifts, the Haselhorsts have helped to do just that, Brown said. In the newly-equipped laboratory, each of the six work stations includes an oscilloscope, a digital multimeter, a power supply and a signal generator, all made by Hewlett-Packard. "It's really top-of-the-line equipment," Brown said. "This is the newest, state-of-the-art instructional lab instrumentation that you can get."

Among other things, the equipment allows students to energize electronic circuits they have built and make physical measurements of voltage, current and time, which is a valuable practical experience, Brown said. "Students are using cutting-edge technology in this lab," he said. "When they leave SDSU and go into industry, they'll find the equipment they learned on is second to none. They'll already be familiar with several important tools."

Another advantage is that each of the new instruments can be connected by cable to a personal computer. This will allow students to gain experience in programming testing equipment, which engineers do in industry, Brown said. "That has been a dream of mine," he said. "It opens up another possibility for us to include in our instructional program."

Private donations like the Haselhorst gift are essential to maintain the high quality of education at SDSU, Brown said. "I don't know how we would get along in our department without that kind of support," he said. "We'd be extremely limited without private donations. They really help us do special projects to benefit the students and improve the academic environment. Electrical engineering has a lot of faithful givers who have helped us."



Top: Two electrical engineering students work on a project for a Circuits II laboratory at one of six stations supplied with new instrumentation.

Bottom: Electrical engineering students in a Circuits II laboratory taught by graduate student Pat Story use new instrumentation provided at six work stations by gifts to the Donald and Nancy Haselhorst Engineering Equipment Fund.

# Mittan improves airline auto-pilot compass

When you fly with a commercial airline, you may have an SDSU alumnus to thank for keeping the plane on course.

Dan Mittan, a 1995 electrical engineering graduate, used information he learned in an SDSU class to improve the design of a flux gate compass, which controls an airplane's auto-pilot and keeps it on course.

Mittan began working at MTR of Brookings in June 1994. MTR

"Rockwell Collins had been building the compasses for more than 10 years, but they were having a high failure rate, which we corrected," Mittan said. "In Dr. Lewis Brown's Signals and Systems Two class, I learned how to use fast Fourier

transform, which is what I used to correct a problem with the testing of the flux gate compass."

MTR signed a multi-million dollar contract to build the compasses in fall 1994 and in spring 1995 the

company began supplying Rockwell. More than 150 aircraft now use the compasses.

"Everything is going well in the production process," Mittan said. "We recently started our own injection molding of the plastic parts for the compass."

The part has been approved by the Federal Aviation Administration. Now the company needs FAA approval to recertify returned parts for airworthy travels. MTR anticipates FAA approval this spring.

"The FAA needs paperwork to explain how we will test it," Mittan said. "They want us to verify that it will withstand temperature extremes and will be accurate to plus or minus one degree."

Mittan is also MTR's quality control manager, so he is in charge of verifying that all parts the company uses are ready for production and that manufactured pieces meet customers' quality standards.

manufactures electro-mechanical devices, including security display modules for prisons, parts for copy machines and voltage suppressors for motor drives. He was hired as project engineer to set up the procedures to design, test and manufacture the flux gate compasses.

*Dan Mittan, 1995 SDSU electrical engineering graduate, is project engineer in charge of setting up procedures to design, test and manufacture flux gate compasses for MTR in Brookings.*





# Espeland has diverse, distinguished career



Marvin Espeland's 30-year career with the Federal Highway Association (FHWA) took him to many states and included experiences ranging from bridging a swamp to writing legislation. However, since his retirement in 1991, the 1959 SDSU civil engineering graduate and Glenham native has enjoyed the opportunity to work part-time and live full-time in his home state. He now serves as Western Satellite coordinator for the Transportation Technology Transfer Service (T3S), a joint program between SDSU and the South Dakota School of Mines and Technology.

Espeland served in the U.S. Navy before attending SDSU. After graduation he worked for a contractor in Missouri. He joined the FHWA in 1961, working in Division offices in Oklahoma, California, Louisiana and South Dakota.

He rose through the ranks to become division administrator, the top state FHWA position, in North Dakota and later in Ohio. At the end of his career, he worked in Denver, Colo., as deputy regional administrator for FHWA Region 8, which includes six states.

Espeland's career included involvement in some unique projects. While working as an area engineer in Baton Rouge, La., he helped find a way for Interstate Highway 10 to cross two swamps. In one case, crews bridged more than 30 miles of swamp. In the other, they removed tons of mud and decomposed vegetation and pumped in sand from the Mississippi River to create a roadway.

"We really had to use two completely different methods of building through that swamp country, and that's what made it so interesting," Espeland said.

Espeland was transferred to FHWA headquarters in Washington, D.C., shortly after the passage of the 1969 Environmental Policy Act. Through what he calls a "fluke" of timing and circumstance, he ended up developing

FHWA's policies and procedures to implement the national environmental legislation pertaining to highways.

Because environmental laws were new at the time and many people did not believe they would be upheld over the years, Espeland did not realize what a lasting impact his contribution would make.

"Those policies are still generally intact," he said. "They have changed some, but the basic content and context are still in place."

In his current position, Espeland works with people involved in the construction and maintenance of state, county and city roads.

"They're really open to us," he said. "That's what I enjoy most, the warmth and appreciation we receive from clients."

Ken Skorseth, SDSU's T3S field services manager, has enjoyed working with Espeland over the past four years.

"I know it's a bit of a cliché to say this, but he's a people person," Skorseth said. "Marv is every inch a professional, but he also cares about people, great or small. He can go out and talk to all of them."

Years of involvement in Toastmasters International helped Espeland become a skilled communicator, Skorseth said.

"His engineering education he got here at SDSU, but his education didn't stop when he walked out of these halls," he said. "By going further on his own, he enhanced his communication skills. He added another dimension to his career, and it really helped him."

Espeland said a South Dakota upbringing and an SDSU education are key ingredients for success.

"I really have to tip my hat to SDSU," he said. "We had a huge number of people within the Federal Highway Administration who graduated from SDSU. When I saw how we stacked up to others, I saw we had something to be super proud of as far as being from the state and from the school."

In his free time, Espeland enjoys hunting, fishing and watching rodeo. He and his wife, Beverly, live in Rapid City and are involved in many civic and community activities.

*"I really have to tip my hat to SDSU. We had a huge number of people within the Federal Highway Administration who graduated from SDSU. When I saw how we stacked up to others, I saw we had something to be super proud of as far as being from the state and from the school."*

## SDSU alum named president of national organization

The smiling face of an SDSU alumna was featured on the cover of a national magazine. Richard B. Hayter, a 1965 mechanical engineering graduate, was named 1995-96 president of the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE). He graced the cover of the August 1995 ASHRAE Journal.

Hayter is associate dean of engineering for Extension and Outreach at Kansas State University. Prior to his present position, he served in the Air Force and was executive vice president of an engineering consulting firm specializing in energy management in commercial and industrial buildings. A licensed professional engineer, Hayter was a member of the Kansas Governor's cabinet as director of the Kansas Energy Office.

He is an ASHRAE Fellow, a recipient of the ASHRAE Distinguished Service Award and an SDSU Distinguished Engineer. Hayter earned his master's and doctoral degrees from Kansas State University.

Hayter's father, Ken, was the director of the SDSU Physical Plant for several years. Hayter and his wife, Barbara, are both Brookings natives.

## SDSU alum designs revolutionary instrument

It's an oscilloscope! It's a logic analyzer! No, it's really a logic analyzer that acts like an oscilloscope. The Hewlett Packard HP 54620A is a 16-channel logic analyzer that measures voltage levels in digital channels. Steve Warntjes, a 1983 SDSU electrical engineering graduate, was lead designer on the project.

"It's the first logic analyzer of its kind in the world," Warntjes said. "It runs like an oscilloscope, so it's very easy to use. Since it is very efficient, you can get your job done more quickly. It is also price competitive."

The logic analyzer was named "The Best in Test" for 1994 by Test and Measurement World magazine. Now Warntjes is project manager of an 11-person team for a follow-up product.

Since graduating in 1983, Warntjes has worked for Hewlett Packard in Colorado as a technical support electronics engineer, research and design electronics engineer, European sales development/applications engineer and research and development lead engineer.

He and his wife, Susan, have three children, Tyler, Morgan and Hannah.

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**Yes,** I wish to contribute to the SDSU College of Engineering through the Greater State Fund.

The College of Engineering appreciates the generosity of alumni and friends who have made gifts to the College, and asks that you encourage others to contribute. All donations should be made payable to the Greater State Fund and designated for the College of Engineering. Mail to: **SDSU Foundation, Box 525, Brookings, SD 57007**

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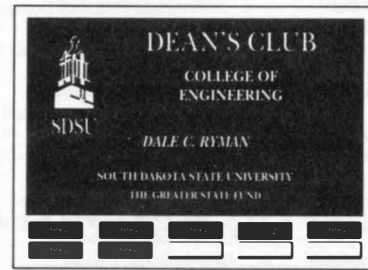
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Daniel P. Apland '70  
Steven C. Arbach '80  
Scott L. Archer '75  
Elmer L. Arment '77  
Pamela J. Arment '78  
Kelly J. Armfield '90  
Milo F. Arms '42  
James A. Arndt '72  
Patricia K. Arndt '72  
Richard N. Ashley '59  
Steven M. Ashton '91  
LeAnn R. Askew '78  
Lynn E. Askew '89  
Ronald B. Aten '67  
Ho-An Au '72  
Nadeem F. Audeh '57  
George A. Auer '64  
Renae D. Aughenbaugh '92  
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Richard B. Augustin '82  
Thomas V. Augustin '70  
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Robin L. Austin  
Karen K. Authier '77  
Philip D. Authier '77  
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Timothy J. Axlman '81  
Robert J. Babcock '85  
Ronald C. Backer '65  
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Doris E. Baddeley '45  
Robert H. Baddeley '45  
Marvin Bail '59  
Barbara Bailey  
Harold S. Bailey  
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George L. Baker '77  
Janet M. Baker '89  
Paul D. Baker '79  
Ruth A. Baker '86  
Steven C. Baker '73  
William W. Baker '88  
David L. Bakke '78  
Diane G. Bakke '81  
James B. Bakkedahl '70  
Paul H. Bakken '83  
William B. Baldwin '40

Ronald L. Ball '58  
John C. Ballard '61  
Linda K. Baloun '92  
Mark N. Baltzer '92  
Russell J. Balvin '86  
Cathy M. Bambenek '95  
Sailesh Banaji '91  
Daniene K. Bangert '58  
Mervin L. Bangert '61  
Michael J. Banks '71  
Marion M. Barber '86  
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Keith A. Bartels '67  
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Lawrence E. Bartling '38  
Phyllis M. Bartling  
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Richard G. Bauer '95  
Kristi J. Baum '93  
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Dawn M. Baumberger '89  
Florence G. Baumberger  
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Robert A. Baumberger '78  
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Wade V. Baumberger '90  
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Hoelscher '87  
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Susan Beckman '62  
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Gerald P. Berger '70  
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Dan J. Bierschbach '87  
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Beverly A. Blaze '59  
Francis M. Blaze '59  
Gerald C. Blazey '80  
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Allan J. Block  
Arnold L. Block '68  
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Jerome G. Bly '71  
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Lori S. Bocklund '83  
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Susan R. Boerner '86  
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Larry J. Boever '89  
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Beverly Borstad '72  
Ted A. Borstad '73  
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Gary D. Bosanko '74  
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Michael A. Bosworth '82  
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Dolores Brage  
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Tad R. Broschat '89  
Kristin J. Brost '89  
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Kathleen A. Brosz '64  
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 Patricia A. Cramer '76  
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 Darrel G. Crocker '64  
 Vance A. Crocker '90  
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 Robert M. Crooks '29  
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 Dale H. Crothers '51  
 James W. Crothers '49  
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 Jeffrey L. Curren '82  
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 Carla A. Daggitt '84  
 Mark R. Daggitt '83  
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 John A. Dalager '65  
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 N. James Dam '59  
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 David D. Daniels '61  
 Doug J. Daniels '93  
 Mary Beth Daniels '93  
 Charles O. Danielson '58  
 James E. Danielson '69  
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 Susan K. Darling '80  
 Brent G. Darler '87  
 Patricia M. Dather '89  
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 Carol M. Davis '66  
 Edward W. Davis '61  
 Jennifer J. Davis '89  
 Jonathan P. Davis '91  
 Mary L. Davis '81  
 Paul D. Davis '85  
 Robert D. Davis '69  
 Robert L. Davis '81  
 Roger L. Davis '59  
 Alvin D. Day '63  
 John K. Day '79  
 Leland L. Day '89  
 Nancy A. Day '78  
 Richard A. Day '49  
 Robert E. Day '73  
 David E. De Berg '69  
 Glenn De Groot '58  
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 Lloyd E. De Jong '67  
 Rodney S. De Jong '75  
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 Max M. De Long '61  
 Larry D. De Mers '76  
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 Dean A. De Sart '50  
 Bryan C. De Smet '85  
 Claire O. De Smet '65  
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 Robert C. De Vaney '44  
 Kerry L. De Vries '82  
 Barbara S. DeBates '71  
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 Davonne DeBoer  
 Delvin E. DeBoer '78  
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 Arlo B. DeKraai '70  
 Larry P. DeKramer '80  
 Mark D. DePoe '82  
 David J. DeSmet '93  
 David H. DeVries '66  
 Patty H. DeVries '76  
 Dale D. Dean '63  
 Dennis M. Deibert '72  
 Janice S. Deibert '72  
 Keith F. Deibert '80  
 David L. Deis '78  
 Christie G. Delfanian '78  
 Fereidoon Delfanian '77  
 Marion K. Dempster '50  
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 Everett C. Dill '42  
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 Virgil D. Dilly '72  
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 Charles E. Ditmar '64  
 Albert C. Dittman '58  
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 Craig A. Doeden '83  
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 Mark E. Dolan '83  
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 Louis W. Dornbush '49  
 Maxine F. Dornbush '73  
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 Palmer Dragsten '39  
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 James E. Dunn '47  
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 Doris Durland '44  
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 John B. Durland '41  
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 James O. Edwards '55  
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 Noel H. Egan '56  
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 Ronald L. Ellingson '62  
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 Leon B. Ellwein '64  
 Neil K. Ellwein '77  
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 Sarah A. Ellwein '65  
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 Keely L. Elssasser '84  
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 C. Diane Emmerich  
 Wanhof '64  
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 Vronna B. Endahl '46  
 Todd W. Enderson '87  
 Donald L. Endres '83  
 Keith L. Enevoldsen '94  
 Donald V. Eng '49  
 Wallace N. Enga '65  
 Toni S. Engelmann '86  
 Roger M. Engle '66  
 Noel R. Engler '61  
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 Thomas J. English '85  
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 Marlys Englund  
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 Sandra E. Erickson '88  
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 Leonard J. Erie '46  
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 Selena B. Erstad '91  
 Jerry D. Esmay '66  
 Patty J. Espeset '71  
 Paul A. Espeset '71  
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 Wilbur J. Etbauer '66  
 Adele G. Evans '46  
 Jean C. Evans '44  
 Norman A. Evans '44  
 Thomas D. Evans '49  
 Debra E. Everson '84  
 Robert B. Everson '86  
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 Stephen M. Everson '86  
 Tony W. Everson '94  
 Keith A. Ewy '76  
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 Diane M. Falken '91  
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 Julie A. Falinsson '87  
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 Mickiel P. Fedde '72  
 Juell D. Fee '61  
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 Darren M. Fehr '93  
 Rand E. Feind '74  
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 Adolph P. Fejfar '59  
 Brian J. Fendrich '83  
 George W. Fendrich '59  
 Melvin F. Fenner '52  
 Thomas C. Fenner '56  
 David O. Fennig '65  
 Craig J. Fergen '92  
 James E. Fergen '70  
 Joseph M. Fergen '70  
 Clifford Ferguson '34  
 Wayne A. Fieback '83  
 Janel K. Fiksdal '81  
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 Carmen C. Fink '90  
 Merrill P. Fink '86  
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 Bruce D. Firkins '74  
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 Andre J. Fischbach '84  
 Mary A. Fischbach '84  
 Gregory L. Fischer '81  
 Rodney Alan Fischer '92  
 Franklin E. Fisher '53  
 George A. Fitzgerald '34  
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 Stephen J. Flanagan '72  
 Gerald F. Flannery '69  
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 Francis L. Flesner '63  
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 Robert S. Fodness '49  
 Darrin J. Foell '91  
 Betty K. Foley '67  
 John E. Foley '67  
 Craig J. Follt '86  
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 James C. Folkerts '63  
 John C. Foikerts '92  
 Craig L. Foreman '71  
 Larry R. Foreman '72  
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 Trudi Foreman  
 Debara S. Forest '74  
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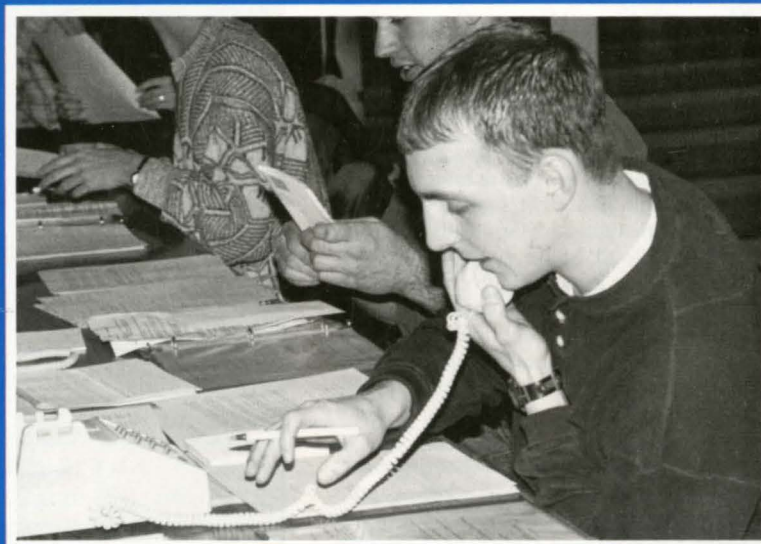
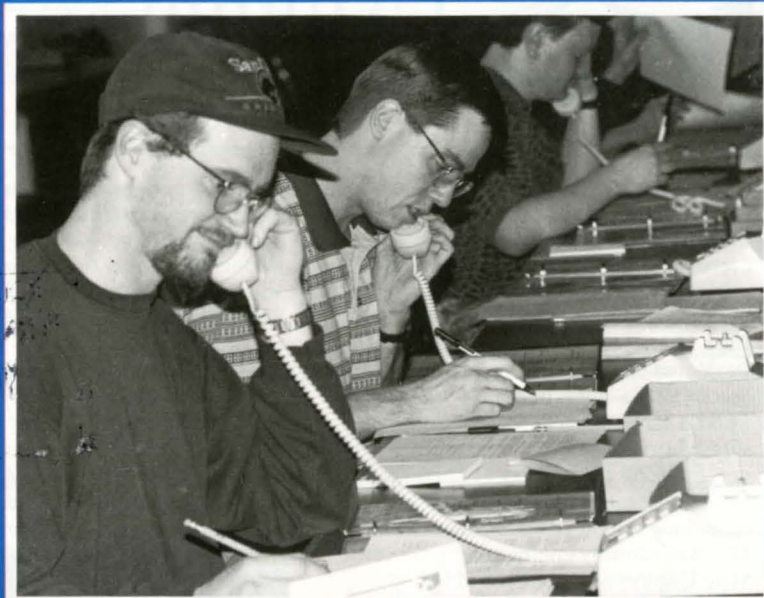
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 Patricia S. Wheeler '84  
 Rodney D. Wheeler '75  
 Darrell D. White '59  
 Ms. Evelyn M. Whitney  
 Robert A. Whitney '48  
 James H. Wichmann '61  
 Kristy J. Wickett '87  
 Matthew A. Wickett '87  
 Michael C. Wickett '91  
 Donald W. Wickler '50  
 Margaret Wickler '50  
 Charles D. Wiedenman '53  
 Douglas M. Wiedenman '63  
 Dale J. Wiese '85  
 Scot Wieseler '83  
 Charles R. Wieting '63  
 Kathryn Wieting '63  
 Bradley W. Wiitala '82  
 Donald K. Wika '52  
 Diane M. Wilaby '82  
 Donald D. Wilaby '79  
 Archie D. Wilcox '53  
 Doniese M. Wilcox '76  
 Ethel H. Wilcox  
 James C. Wilcox '76  
 Mary E. Wilcox '86  
 Jack W. Wild '48  
 Robert A. Wiles '57  
 Ver Dell R. Wiles '56  
 Barbara M. Wilkens '52  
 John M. Wilkens '66  
 Paul C. Wilkens '69  
 Robert A. Wilkens '51  
 Susan R. Wilkens '71  
 Gina L. Will '93  
 Nathen A. Will '92  
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 Kathy Willard '70  
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 M. James Willard '61  
 Kathleen E. Willcuts '81  
 Robert K. Willcuts '82  
 Leonard R. Willett '47  
 Dawn D. Williams '90  
 Derek S. Williams '88  
 Hank Williams '55  
 Merlin C. Williams '53  
 Perry W. Williams '39  
 William A. Williams '89  
 Cathy Williamson  
     Edward J. Williamson '47  
 Sidney P. Williamson '65  
 Harry W. Willmott '66  
 Richard K. Wilson '52
- James M. Wimsatt '60  
 Rick J. Windschitl '87  
 Janice Winter '62  
 Marlyn W. Winter '62  
 Verne J. Winter '67  
 Kristen L. Winters '94  
 Kevin T. Winterton '81  
 Bryan T. Wipf '94  
 Joel D. Wipf '89  
 Gregory J. Wirt '82  
 Gordon G. Wiseman '38  
 Mavis L. Wiseman '40  
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 Timothy A. Wittig '76  
 Richard D. Wittmeier '90  
 Terrance P. Wixon '75  
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 B. Todd Wohlwend '90  
 Cyle E. Wold '88  
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 Emerson Wolfe '34  
 John W. Wolfe '39  
 Walter L. Wolles '62  
 Susanne J. Wollman '85  
 Steve Wolterstorff '87  
 Charles J. Wondra '48  
 Dirk E. Woodard '73  
 Edna M. Woodworth '73  
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 Roger I. Woodworth '61  
 William Woodworth '53  
 Barbara A. Woolworth  
     Donald J. Woolworth '57  
 Worden, Fred O. Estate  
     Le Roy S. Woznak '59  
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 James W. Wyland '50  
 Kenneth D. Wyman '51  
 Dwaine H. Wynia '61  
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 Helen Brooks Yetter '55  
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     Kenneth L. Yocum  
     LaVerne J. Yocum '61  
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 SueAnn P. Yonkovich  
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 Roger L. Z-barth '59  
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 Russell R. Zellmer '92  
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 Harland C. Zenk '59  
 Carmen L. Zettle '44  
 Eugene V. Zettle '44  
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 Sandra Z. Zhou '88  
 Lois A. Ziebol '86  
 Robert J. Ziebol '86  
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 Dennis J. Zimmer '89  
 Stanley J. Zimmer '47  
 William E. Zitterlich '73  
 Kenneth O. Zoellner '73  
 Scott J. Zweep '86  
 Donald M. de Blonk '63





*Engineering students man the phones during this year's Engineering Phonathon Feb. 19 through 23. Money pledged during the Phonathon helps pay for laboratory equipment and funds faculty development, student activities, student assistance, the Impulse publication, the Phonathon and Engineering Exploration Days at SDSU.*



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