STUDENT SUCCESS SPARKS RAYS OF ENERGY ON CAMPUS

Exactly one year ago I was on this campus for interviews looking to return to this great university as its dean of the Jerome J. Lohr College of Engineering.

Obviously those interviews went pretty well. Since July 1, I have been serving as dean. Actually, I spent several days on campus in June to gather some insight from my predecessor, the gracious Lew Brown. The months that followed have been the fastest of my life—renewing old acquaintances and making new ones, determining directions for facility upgrades and crafting an operational plan for the college’s research.

The list just goes on. However, keeping tabs with all that is going on here fuels me with energy, which I felt during those campus interviews.

Reading through this issue should give you a taste of this energy.

As one of the college’s benefactors told me recently, “A great college starts with great students.” Inside this issue, you will get a sample of the great students here.

Our human-powered vehicle team continued its winning ways. The steel bridge building and Geowall teams both competed in national competitions and the BotShot team competed in a robotic basketball shooting contest during Final Four weekend in Minneapolis. Other engineering students are demonstrating how 3D printing can be used to build a structure on Mars.

If you had a chance to attend Engineering Expo and see the fantastic Senior Design Projects on display, I know you were as impressed as I was.

Part of what it takes to attract great students is great facilities. We couldn’t be happier with the engineering structures built on the south end of campus in the past decade. Later this year construction will begin on the massive Raven Precision Ag Center, a joint effort between the Department of Agricultural and Biosystems Engineering and the College of Agriculture, Food and Environmental Sciences.

Of course, the study of science and engineering is ever-evolving. That means our facilities must change as well. While there are no new buildings on the college’s short-term priority list, the way we utilize our space within those buildings must evolve. For example, we will initiate the final phase of remodeling for Crothers Engineering Hall this summer.

Plentiful scholarship opportunities are of equal importance to facilities in attracting great students, especially in the engineering, computer science and mathematics.

The impact a scholarship can have is superbly seen through those who have received the Kevin Moe Excellence Scholarship. It has definitely been the launching pad for successful careers. Of course, the Moe scholarship isn’t unique in that aspect. Virtually every scholarship has the potential to turn a life around. There is no greater gift we can give students today than to help them graduate as close to debt-free as possible.

In the university’s next capital campaign, scholarships will be a major focus. It is our goal to double scholarship offerings in the next five years while increasing undergraduate enrollment 10 to 15 percent.

Woven within that is seeking Board of Regents approval for doctoral degrees in mechanical engineering and computer science and a bachelor’s and master’s degree in software engineering. As we move forward, we need your passion and support more than ever. What will you choose for your impact on the future?
Two-time national champion Christian Laettner shoots baskets against the South Dakota State robotics team member Josh Gross at Land O' Lakes Bot Shot April 7 in Minneapolis. South Dakota State and the University of Wisconsin were declared winners of the event.

Photo by: Bruce Kluckhohn
AP Images for Land O’Lakes, Inc.
Young faculty member Dennis Helder visited the office of fellow electrical engineering instructor Bob Finch in 1986 and saw the book “Digital Image Processing.”

Helder browsed it, was captured by figures showing how blurry images could be corrected, and the spark to ignite a career-shaping fire had been lit. Helder, who grew up on a Canton farm, had only been on the faculty three years after earning degrees in animal science (1979) and electrical engineering (1980), working as a cellphone designer, giving farming a try and earning a master’s degree (1985).

His first role on the faculty was as a graduate assistant working on an electrical tractor.

“I asked Dr. (Virgil) Ellerbruch, (head of electrical engineering), if I could teach a class to see if I liked it.” He was assigned EE211, the foundation circuits class, not as a lab instructor but as classroom teacher. “I found I really liked teaching,” said Helder, who will retire from South Dakota State University June 21.

Counting time spent as a graduate assistant, the distinguished professor and associate dean of research is retiring after 35 years as a South Dakota State employee.

A BOOK THAT CHANGED HIS LIFE

Back in 1987, Helder realized if he was going to make education a career, he needed to have a doctorate. South Dakota State didn’t offer a doctorate in electrical engineering then. Helder was commuting to campus from De Smet, where he continued to farm part time. Going to graduate school in those pre-internet days made location the primary criteria.

“I went somewhere close because I still had a soybean field that needed harvesting,” Helder said of his selection of North Dakota State University.

In fall 1988, when he was in need of a dissertation topic, digital image restoration was still on his mind. Engineering research associate Mary DeVries O’Neill gave him the name of a person at EROS (Earth Resources Observation and Science Center) who might be of help.

A LADY THAT CHANGED HIS CAREER

That person, June Thormodsgaard, was the image mapping and research development section leader. She gave Helder a problem that neither NASA nor EROS could fix. She recalls their first meeting:

“I’m sitting at my desk. All of sudden there’s this lanky body that fills up my entire door. He said he is from Canton, which is my hometown, and that he was looking for a dissertation topic. It was just then that the Landsat Thematic Mapper had started dropping scan lines. We were looking for a fix. There were people around the world that hadn’t been able to correct it.

“Dennis was definitely an electrical engineer ... Gee, I thought maybe he could find an approach to fill in these missing lines.”

She introduced him to her staff and checked on Helder with a university research leader, but she didn’t thoroughly investigate this stranger. “He just struck me as somebody I could trust,” Thormodsgaard said.
Helder proved himself not only trustworthy but also bright. Using a university computer, he figured out an algorithm to remove lines, or bands, from satellite images of the Earth that were created by the camera. A bound copy of “Debanding Thematic Mapper Imagery,” Helder’s dissertation, is still on his bookshelf as is Finch’s copy of “Digital Image Processing.”

So happy was Thormodsgaard with Helder’s work that she sent another assignment his way in about 1990. An unspecified client needed an algorithm to fix satellite images of Saudi Arabia. When the first Gulf War broke out, Helder realized his work had helped the U.S. Department of Defense.

“I owe most of my career to that lady,” Helder said.

FIFTEEN MINUTES THAT NETTED 15 YEARS

Meanwhile, the now-retired Thormodsgaard, said, “It’s a small, narrow group of people that have the expertise Dennis has. He didn’t need anybody. He just needed his hard work and his mathematical brain.”

In 1992, Helder did a summer fellowship for NASA in Washington, D.C. The assistant professor from the overlooked college on the Great Plains explained his research to a skeptical, popcorn-munching supervisor. John Barker spent 15 minutes telling Helder why his project wouldn’t work. Helder listened and went back to his cubicle.

He returned with a project that could successfully calibrate satellite images and made Barker a believer in Helder’s work.

“I did 10 years’ worth of work based on one afternoon’s discussion.” When Barker retired, the bureaucrat’s supervisor assigned all of Barker’s research funds to Helder. “I’ve been running my lab (the SDSU Image Processing Laboratory), in part, on John Barker’s money for 15 years. EROS and NASA have funded our research for decades,” Helder said of the image processing lab’s primary funders.

‘ONE OF TOP GUYS IN THE WORLD’

Through the years, Helder has been the primary investigator on dozens of research projects. He has received grant funding of more than $25 million. The topics include development of ethanol-based aviation gas, alternative power technologies and aviation electronic. But his favorite roots back to what he saw in Bob Finch’s book in 1986—image restoration.

It’s called radiometry. As Helder explains it, “Radiometric calibration turns pretty pictures into quantitative data sets.”

“I’m one of the top guys in the world” in radiometry, he asserts. The humble scientist quickly adds, “There’s a whole 12 of us.”

TARPS CHANGED HOW WE SEE THE WORLD

Another major advancement in the image processing lab’s stature came following a 1998 visit by Helder to NASA’s Stennis Space Center in Mississippi. Soon afterward, he got a call from Lockheed Martin, a company contracting research work with NASA, to develop techniques to measure the amount of blurring in satellite images.

“We became world leaders in this area,” Helder said. It involved a crew of 12 students staking black, white and blue tarps as well as 20 convex, 1-meter mirrors laid out on the open field at the south end of Brookings. After passing satellites captured the image, the crew would tear down the odd sight off 22nd Avenue.

The mirrors allowed the researchers to produce a two-dimensional MTF. “We perfected the tarp method. We came up with methods of perfecting the edge reconstruction,” Helder said.

One claim to fame for the lab is that it calibrated the images taken by the QuickBird and Worldview satellites, which was operated by DigitalGlobe. The firms’ images are used extensively in Google Earth.

CREATED WORLD-RENOVATED LAB

Larry Leigh, who will succeed Helder as director of the image processing lab, was a graduate research assistant in 2001 when he started doing vicarious calibration field work for the lab. He was brought on as a full-time staff member of the image processing lab in 2005 and has been the day-to-day leader in the lab since 2016.

Because of the image processing lab’s worldwide standing in vicarious calibration, he has traipsed through a salt lake in central Turkey and the Algodones Dunes Desert to take reflectance measurements used for calibration.

Leigh said, “Dennis had a big influence on me, and as a mechanical engineer, he brought me into a career path I would have never thought possible. Through Dr. Helder, the IP Lab is world-renowned for its capability to perform on-orbit calibration.”

THE KINGS OF CALIBRATION

Helder said there are three major image processing labs that work in the field of satellite radiometric calibration—the University of Arizona, which specializes in desert targets; Rochester Institute of Technology, which specializes in thermal sensing; and SDSU, which does several types of postlaunch calibrations, but specializes in calibration using vegetative surfaces.

“Our guys are experts at it. People who use the data want to see calibration over vegetation because the most interesting areas of the Earth are vegetated,” Helder said.

“We’ve also become the world leader in PICS (pseudo and invariant calibration sites) based calibration of satellite imagery that uses invariant desert sites throughout the world to convert each pixel in a satellite image to a physical unit of energy. We’ve been working closely with the French government calibration group to set the standards for PICS calibration.

GUIDING HAND BEHIND DAKTRONICS ENGINEERING HALL

The lab is located on the top floor of Daktronics Engineering Hall, its home for the last 10 years and light years better than when it was in Harding Hall, a former dormitory.
Helder, then head of the Department of Electrical Engineering and Computer Science, remembers attending a meeting June 19, 2006, with the SDSU Foundation, then-Dean Lew Brown and university benefactors Al Kurtenbach, Van Fishback and Jerry Lohr, who would become the namesake of the college. After the meeting, Brown and Helder asked one another, “Did we just get a new building?”

They had. Faculty moved into what was initially called the Electrical Engineering and Computer Science Building during a sleet storm March 6, 2009, and dedicated it on sunny May 1. It was the first new instructional building erected on campus since 1993.

The June 19, 2006, and March 6, 2009, dates are on a simple, framed sheet of paper in Helder’s office. Between those dates Helder put in seemingly endless hours in overseeing planning and construction.

“My job was to make sure the building worked for the department. I had to work with architects, engineers, the construction team, campus administration, Dean Kattelmann (campus facilities director), state engineers. I worked with everybody day after day after day. It had to be right,” Helder said.

And it was, and still is, Dean Bruce Berdanier says.

“Daktronics Engineering Hall has been an excellent facility for electrical engineering and computer science, the primary users of the hall. As the applications in those fields evolve, this building can be adapted to match new needs that we couldn’t have imagined 10 years ago. We’re fortunate to have such a useful facility.”

Helder added, “The image processing lab started in a dorm room. It graduated to two dorm rooms. We can put 12 students in the lab now.” As for other areas of Daktronics Engineering Hall, “We have the best clean room in the state and the best optics labs in the state. Faculty offices are on the south side so they have windows with sunshine.

“Classrooms and labs on the north side right across the hall. The conference room has floor-to-ceiling windows. It’s amazing.”

Held estimates he spends 50 percent of his time in his role as associate dean of research, a position he has held since the Office of Engineering Research was founded May 22, 2010.

During nearly a decade in operation, “We have provided a capability for the faculty that they never had before for getting proposals out the door. Since this office has started, we’ve never missed a deadline for grant proposals.

“Jessica Andrews—she does more of the tactical stuff. I do more of the strategic stuff. Tammy (Loban) does a terrific job keeping the office running and all the budgets in order. We have a lot of young faculty members that need the support,” Helder said of the three-person office.

The associate dean for research will be filled on an acting basis by Steve Gent, an associate professor in mechanical engineering. He will start working with Helder in May and then take over when Helder retires June 21. Gent also is chairing the search for a full-time associate dean of research. That search began this spring.

WHAT DOES THE FUTURE HOLD?

As for Helder, who turns 62 July 15, he will be camping at Custer State Park June 24 as he has scheduled a week of hiking with his 15-year-old grandson. He also enjoys shooting, hunting, portrait photography and is an amateur magician for his 10 grandchildren. He also is considering working part time in the calibration field.

In addition, Helder is committed through August on an elite team that is crafting what the next version of NASA’s Landsat satellite should be like.

“I’ve really been blessed to work at SDSU for 35 years doing what I enjoy and being surrounded by great people who also are passionate about what they do.”

Dave Graves

CAREER (all at SDSU unless otherwise noted):
Associate dean of research, May 22, 2010-present; head of electrical engineering and computer science, 2003-2010; professor, 2001-present; head of electrical engineering, 2001-2010;
   Director of Engineering Research, 1997-2010; director of Environmental and Engineering Research Center, 1994-97;

FAMILY: Wife: Susan ’80, a nurse by training. Children: Virginia (Jon) Sprang, part-time graphics designer, Gracepoint Church, Brookings; Benjamin (Polina), Volga, IT specialist with Capital Card Services; Camden (Sarah), physician assistant, Brunswick, Georgia; Lara (Stephen) Nash, now of Brookings but soon moving to Dallas with Wycliffe Bible Translators; Ethan (Kayla), De Smet, chiropractor. Dennis adds: “We also have 10 grandchildren on the ground and 2 in the oven!”
When Xijin Ge learned South Dakota State University was not only going to add a high-performance computing cluster (HPCC) but also add a 100-gigabyte internet connection, he was excited.

“I was like a kid in a candy store, just so excited about the speed in which I was going to be able to run data sets,” said Ge, an associate professor in the Department of Mathematics and Statistics. He conducts research on what causes cells to divide at the beginning of life as well as contamination of cells. “After running more than 2,000 data sets in a couple of days, I have enough data to write a paper. Without the new cluster, it would have taken months.”

Mike Adelaine, the university’s vice president for technology and security, said the new cluster’s speed is like having 3,000 high-performing desktop computers working in unison. A cluster is typically a series of networked computers.

The university previously had only a 10-gig internet connection. South Dakota State was the first university in the regental system to have the 100-gigabyte speed. Adelaine added the new internet connection is similar to comparing the autobahn to a county highway.

University Networking and Research Computing’s Kevin Brandt ’01/M.S. ’08, Chad Julius ’01 and Brian Moore saw the need for more computing power. They said the HPCC, also known as Rolling Thunder, provides a foundation for building research opportunities on campus, and they look forward to assisting more faculty members in learning how to use the cluster, which went online in November and has already provided more than 2.5 million computer hours of processing time.

Jeff Doom, Steve Gent and Tim Hansen are among those Jerome J. Lohr College of Engineering faculty already running programs on the HPCC. Hansen uses the cluster for computations related to his research on optimizing electrical grids and also teaches a course on high-performance computing.

“The beauty about RT is that we basically have a tool that has the capabilities of an XSEDE-type cluster, which is phenomenal,” Doom said. “It’s a great machine on which to do research. I’ve been running my code on it for several weeks and the results look amazing. We’ll keep working and should get a journal paper out of it.”

Gent and graduate students Dillon Pedersen and Weston Christensen use the HPCC for several fluid dynamic simulations. Pedersen and Christensen are both reviewing the different designs of neutrino detectors.

“To do this on a high-end workstation, it’d probably take a year to do each simulation, and with the new cluster, Dillon and Weston are able to turn around those simulations in a couple of days,” Gent said.

“I sometimes do one iteration at a time to try to figure out what’s going on, and those take 30 seconds to minute; while in the cluster, it takes maybe a second,” Christensen said. “When you have to solve the tens of thousands of iterations we need to do to get to the right solution, if we can do each iteration in one second versus 45 seconds, we’re talking massive time savings.

“After graduation, I want to work for a bike designer and use this software to model flows around frames and components,” he continued. “It takes a lot of computing power if you want to get a fine resolution and really know what’s going on with the fluid flow. The fact SDSU has it is a really good experience you can’t get at every university.”

Ge looks forward to what’s next.

“Once you have the technology, you start to think about what’s possible,” Ge said. “I’m analyzing massive amounts of data. If you have a good question and the technology, there are a lot of opportunities. The more power available means the more I can do. I’m optimistic about what we can do.”

Matt Schmidt
After helping the Jerome J. Lohr College of Engineering develop its strategic plan, the Research Park at South Dakota State University has seen an increase in the number of the college’s faculty seeking an address at the research park.

Dwaine Chapel, the park’s CEO and executive director, said the strategic plan allowed the college and the park to focus on recruiting industry, recruiting and developing faculty who want to work with industry or are interested in developing innovative technologies and commercializing that research.

Currently at the park are: Qiquan Qiao, the Harold C. Hohbach Endowed Professor in Electrical Engineering, Nano Tek LLC; Tom Brandenburger, an associate professor in the Department of Mathematics and Statistics, Merchant Boost; and Steve Gent, an associate professor in the Department of Mechanical Engineering, Dynoflo Analytics LLC. Chapel said plans are in the works for others to join them but the park is currently at capacity.

“Part of my work is to work with faculty members on their research and help with economic development, including a startup company or if they have intellectual property they lease to another company,” said Dennis Helder, who has announced his retirement after serving the college for 35 years, 21 as its associate dean of research. “The strategic plan came about as a result of Dwaine Chapel’s persistence in finding a way to connect the Research Park with the college.”

“Knowing the competition for funds is increasing faster than the money is increasing, I thought we should consider diversifying our funding sources,” Helder continued. “I thought how can we partner with companies in the area to tackle research and bring about economic development? The Research Park has always been willing to work with any of our faculty to help them. I’ve never heard Dwaine say ‘we don’t have money.’ He always finds a little to help test drive their idea.”

Those funds have come from many sources.

“We’ve provided letters of support and seed funds to help them raise nearly $1 million collectively from May to December,” Chapel said. “One aspect of the relationship with the college is that we are able to identify industry interested in working with these types of companies. We have found serial entrepreneurs and we focus on finding College of Engineering alumni to be coaches, investors or mentors. We can do that with economic modeling software, which has been a huge success for us as it was one of the ways we were able to identify potential clients for Qiao and the others.”

Gent’s firm moved to the park in November 2018. It focuses on providing high-fidelity modeling simulation services for companies.

“We’ve seen there is significant interest in using simulations to look at optimizing products and processes but there is still
Interested in moving your idea to the Research Park?
Dwaine Chapel said the first step would be to stop by.

“We have a plethora of assets and can march one through the application, which also serves as a needs assessment,” he said. “Of course, a faculty member can call the Research Park and we can help navigate the process.

“The application indicates what needs you might have, whether they’re financial, trademark/patent or if you need a CPA or similar. We have those assets in the building, and we also have access to the Enterprise Institute and have developed a strong relationship with the state’s SBIR grant writer,” Chapel continued. “After we know your needs, we’ll know where to plug you into the business lifecycle and can cross-reference that with industry or niches that fit into their skillset and try to create networking opportunities for everyone.”

Steve Gent is grateful for the help he received from the university and department administration regarding his decision to move to the Research Park.

“Dwaine, Melissa and Ashley as well as other leadership at the Research Park have been outstanding to work with in terms of getting us established,” Gent said. “I presumed it would not have been as seamless as it has been.”

a fairly high threshold to be able to understand how to use the software tools and use them effectively,” Gent said. “Our focus is on medical device developers and companies on evaluating product designs, provide them with results and then make recommendations. We can work with and have worked with other industries, too.

“The FDA has become more open to using simulation-based data as scientifically relevant. We hope to be a leader in doing that,” he continued. “We’re looking to get results done in weeks rather than months as time is of the essence for companies.”

Chapel said the Research Park has strived to be a point of access, not only for startup companies but also entities looking to provide capital or partner on research and development work.

“Because of the partnership with College of Engineering and identifying business opportunities and technologies to commercialize, the Research Park has set up and recently launched its Research Park capital fund, an angel fund of $1.3 million to invest in these companies. It’s pretty exciting news but I wouldn’t have been able to do that without this relationship. The success of the Research Park is based upon the relationships we build with SDSU and its alumni.”

Matt Schmidt
LIKE FATHER, LIKE SON
REECE KURTENBACH HONORED AS DISTINGUISHED ENGINEER

Twenty-eight years after his father was likewise honored, Reece Kurtenbach ’87 has been named a Distinguished Engineer by the Jerome J. Lohr College of Engineering.

Aelrud Kurtenbach, co-founder and then president of Daktronics, received the college’s accolades in 1990 at age 56. Reece Kurtenbach, 54, the third of five children born to Al and Irene Kurtenbach, was honored at the Distinguished Engineers and Scholarship Banquet April 24. The current Daktronics president and CEO becomes the 141st recipient since the honor was begun in 1977.

Reece’s employment with Daktronics dates to mowing the grounds as a teenager and then working the night shift as a college student.

For the first two years of college, Kurtenbach lived in Binniewies Hall and participated in intramural football, basketball and water polo as well as getting involved in a couple of study groups. But his major extracurricular was the night shift at Daktronics. “I was learning and trying to drive my engineering knowledge forward. I got a good balance between my studies at SDSU and the different areas that I worked at Daktronics.”

His student experience at Daktronics also was balanced. In his junior year, he moved to project management to help work with some line-based LED products that Daktronics had purchased. After a year, he transferred to customer service and worked in the repair center and on the help desk.

In the summer he would hit the road, doing equipment maintenance for customers on a loop that covered all of the Midwest, from Northern Minnesota to Arkansas.

For his last six months as a student employee, Kurtenbach worked in one of the engineering areas, voting systems, doing troubleshooting and design verification.

FULL-TIME CAREER DATES TO 1991

His full-time Daktronics career began in January 1991 as an applications engineer where he was assigned the multisport venue All-African Games project in Cairo, Egypt. “This was a great learning experience and gave me a solid foundation as I went on to manage a number of other large, complex projects,” he said.

After three years, he was promoted to manager of video products, a position he held for more than 10 years. It was at this time Daktronics pursued full-motion video using blue and green LEDs that became available in the mid-1990s. “This development sparked a technology race that affected our entire industry,” Kurtenbach said.

Daktronics engineers began work in late 1995 and the first displays were placed in fall 1997. In addition to mastering full-color video and video processing, engineers had to develop system control, LED module design and a high tolerance chassis as well as many production processes and quality control techniques to do this consistently over time.

The first full-color LED video display boards were installed in football stadiums at Oklahoma, Clemson and Washington State University in time for the 1997 season.

MILESTONE PROJECTS

As the technology was perfected, Daktronics’ sales quadrupled from $30.5 million in 1993 to $123 million in 2000 with boards popping up at numerous professional sports stadiums, including Fenway Park, Dodger Stadium and the New England Patriots’ Gillette Stadium.

While Daktronics has done many high-profile projects, Kurtenbach said the ones the firm is most pleased with are when customers come back time and time again.

One example is the Cleveland Indians, who have ordered scoreboard displays three times from Daktronics: In 1994 for the opening of the Jacobs Field, in 2004 and in 2016, when Daktronics installed North America’s largest scoreboard.

Other examples are:

• The Tampa Bay Buccaneers at Raymond James Field, where the 1998 installation was one of the first large-format NFL video displays and a new Daktronics system was installed in 2015.
• Lehman Brothers (now Barclays) at 745 7th Ave. New York City, where the Times Square Spectacular was installed in 2001 and refreshed in 2016.
• Lamar Advertising, which purchased its first outdoor digital billboard in 2000 and has been purchasing new and replacement systems regularly ever since.
• Then there is Mercedes-Benz Stadium, home of the Atlanta Falcons and the site for the 2019 Super Bowl. In 2017, the Halo display was completed. Measuring 58 feet high and 1,075 feet in circumference, it is the largest video scoreboard in the world; large enough for a helicopter to fly through it.

CLIMBING CORPORATE LADDER

In 2004, Kurtenbach became vice president for video systems and in 2007 vice president for the live events and international business units. He spent a year as executive vice president under Jim Morgan in 2012-13 and then succeeded him as president and CEO in 2013.

Under his leadership, sales have topped $500 million, a manufacturing plant was started in Shanghai and a production facility was purchased in Ireland.

In fiscal year 2018, Daktronics had all-time highs in sales ($610 million) and gross profit ($146 million). It has 2,400 full-time employees and 300 part-time or student employees with the majority of each category working in Brookings.

Lew Brown, the former dean for the Lohr College of Engineering, nominated Kurtenbach because “Reece has had an incredible career since he graduated from SDSU in electrical engineering in 1987. Daktronics is recognized around the world as the leading designer and manufacturer of LED message and video displays. Reece Kurtenbach has played a key role in leading the company to its present position.”

Kurtenbach and his wife, Kami, have four daughters, three of whom are graduates of the Lohr College of Engineering.

Dave Graves
A NASA-sponsored contest to design and build shelters for astronauts on Mars has taken 3D printing to new heights at South Dakota State University.

About a dozen mechanical engineering students have built a 3D printer that stands 10 feet tall and operates on a 14-by-21-foot base as part of NASA’s 3D-Printed Habitat Challenge. The students began the project in January 2018, working under the supervision of Assistant Professor Todd Letcher of the Department of Mechanical Engineering.

“Space manufacturing is something we think about a lot,” Letcher said, pointing to his collaboration with Made In Space, a manufacturing company that is developing 3D printers for the International Space Station. “The NASA project fits perfectly with the type of things we like and can do here.”

The 3D-Printed Habitat Challenge has three phases—the habitat design competition, structural member competition and the on-site habitat competition. Last summer, the SDSU team submitted an architectural drawing of its habitat design.

For the structural phase, each team builds a 3D printer with which to construct the shelter and formulates their printing material based on competition guidelines. SDSU’s 3D printer has been operational since November 2018. They needed to submit a video of their machine printing a water tank by April 1.

For the final phase, NASA invited the top teams to bring their 3D printers to Peoria, Illinois, and build a 1/3-scale version of their shelters in a head-to-head competition April 29-May 4. Those teams will compete for $2 million in prize money. However, the SDSU team will not head to Illinois.

A majority of the contestants are private businesses, with only a handful of universities, including Pennsylvania State University and Colorado School of Mines, competing. Funding for the SDSU project comes from private donors.

“This is such a nontraditional project. Every part of it is different from the normal way of doing things in a regular engineering scenario—that forces students to adapt,” Letcher said. “The students have learned a lot.”

DESIGNING CONTROL SYSTEM

Graduate student Clinton Kolbeck of Sheldon, Iowa, worked full time last summer on the project through his research assistantship. He, Ryan Fouts of Moville, Iowa, and Sheldon Rasmussen of Atwater, Minnesota, developed the control system.

“We wound up being the electrical engineers for the team,” said Ryan, who never expected to use what he’d learn in the electrical engineering classes that mechanical engineers are required to take. “My [electrical engineering] knowledge has grown exponentially as a result of being a part of this project.”

“We did the whole control system and rewired it multiple times—it’s been the steepest learning curve,” Kolbeck said. “I learned how involved the design process is and how important it is to do testing and proof-of-concepts first to make sure things work.”
For his thesis, Kolbeck will incorporate a visual processing system into the 3D printer design. That will allow the system to visualize the terrain and print around or avoid an obstacle.

**SELECTING MATERIALS**

Senior Blake Johannsen of Sergeant Bluff, Iowa, said, “Lots of small problems caused big issues that we had to overcome—that improved my problem-solving skills.” He is part of the extrusion team, which worked closely with the materials handling team to formulate the printing material.

Alex Gray, a senior from Barrington, New Hampshire, said, “We tried different grits of sand and sandblasting media.” However, the students found materials that moved well through the tubing that connected the storage bins to the extruder did not necessarily work well structurally.

To evaluate their mixtures, the students did compression and tensile testing on dogbone specimens and X-rayed bricks-sized samples to make sure the material was evenly distributed. “There was a lot of guess-and-check work to determine what was best,” Gray said. The students chose a combination of high-density polyethylene (HDPE) plastic and sand.

“You want to minimize the amount of material that has to be brought to Mars to build the habitat and to use as little water as possible,” Letcher said. “HDPE plastic is easily recyclable and commonly used in transporting space cargo. The sand simulates Martian topsoil.”

**BUILDING ON EXPERIENCE**

Senior Huy Hoang Trinh said, “The huge scale of the 3D printer got me into this project.” He hopes to use what he’s learned about 3D printing when he returns to Vietnam.

Senior Jason Scheffert of Valparaiso, Nebraska, said, “The biggest thing I’ve learned is how to communicate with other groups to ensure our designs work well together.” Trinh, Scheffert and Ross Wick were on the gantry team, which was responsible for printer movement. They worked closely with the controls team and the structural team.

Wick, a senior from Lakeville, Minnesota, said, “I gained a better understanding of mechanical design and the design process.” For his capstone senior design project, Wick said, “I’m taking the whole thing and putting it on tracks so we can drive it around.”

The senior design project will help Letcher accomplish his next goal, making the printer mobile. “It can work like a hub and a spoke to build segments of a building. That’s another concept that NASA is interested in for building settlements on Mars.”

_Christie Delfanian_
Zhen Ni, an assistant professor of the Department of Electrical Engineering and Computer Science, will receive the Aharon Katzir Young Investigator Award at the July International Joint Conference on Neural Networks in Budapest, Hungary.

The award from the International Neural Network Society goes to the most promising young investigator in the field of neural networks.

“This award encourages me to look further to solve some of the fundamental challenges in the field of neural networks and machine intelligence,” Ni said. His research will help develop intelligent learning control systems that can mimic the human decision-making process. These intelligent systems could help evacuate people in an emergency situation, such as a fire in a shopping mall, or allow a robot to autonomously move, navigate and scout in an extreme environment.

INNS evaluates young investigator nominees based on their research records, quality and impact of their publications, research funding resources and service to the society.

Formed in 1987, INNS is one of the oldest and largest organizations for machine networking. “The organization is a major driving force in our field of neural networks and modeling behaviors, brain processes and brain-inspired computers,” Ni said. “It is a very interdisciplinary group, which includes engineers, computer scientists, neuroscientists and biologists.”

Ni began working in the field of neural networks nine years ago as a doctoral student at the University of Rhode Island. He came to South Dakota State after completing his doctorate in 2015.

In 2016, Ni received the University of Rhode Island Excellence in Doctoral Research Award. His research has generated 27 peer-reviewed journal papers and 47 peer-reviewed conference papers.

At South Dakota State, Ni is a principal investigator or co-principal investigator on two National Science Foundation awards, a NASA EPSCoR grant, a Department of Commerce grant and a South Dakota Board of Regents grant.

He has supervised two doctoral students and eight master’s degree students, including five who have completed their degrees and are working in industry or pursuing doctorates.

CORRECTION:

Jeff Nelson ’71, the retired East River Electric executive who emceed the Oct. 1, 2018, Center for Power Systems Studies banquet, was misidentified in a picture on P. 12 of the fall issue. From left are, Steve Hietpas, Grant Metzger, John Kappenman and Nelson.
WHERE SDSU ENGINEERING GRADUATES DESIGN FOR SUCCESS

HOLDEN SURAT, CSC17
SOFTWARE DESIGNER

"Graduating from the Computer Science program at SDSU set me up for success by developing my problem solving and analytics skills. Working at Daktronics not only lets me leverage the skillset I’ve gained, but also expand on those skills by encouraging developer creativity."

www.daktronics.com
After growing up around construction sites and blueprints, Mike Schultz ’75 thought construction and the building industry would be a rewarding career and earning a bachelor’s degree in civil engineering would be a stepping stone to make that happen.

He was right.

While Schultz doesn’t have his own construction company, he’s been the U.S. Army’s chief of construction, overseeing the building program and projects around the world in support of the Army’s growth, re-stationing and modernization. He’s continued that role with the Army’s Corps of Engineers constructing military projects Ellsworth Air Force Base and managing the Civil and Military programs across the Southwestern U.S.

Commissioned a second lieutenant in the U.S. Army following graduation, Schultz’s military career lasted over 29 years before now serving as a civilian for the U.S. Army.

At a Senior Executive Service Induction Ceremony Nov. 13, Schultz was inducted as a member of the Senior Executive Service and is now serving as the U.S. Army Corps of Engineers’ Chief of Interagency and International Services.

“I never imagined during a military career of 29 years in uniform and now as an Army civilian, that I’d make this sort of contribution,” Schultz said. “As a student, I never envisioned this career outcome when plowing through structures, mechanics and hydrology and the numerous other courses in the civil engineering program.

“The role I’m now in supports the Army and DoD mission as part of its executive leadership team. I’ll be able to influence what we’re doing from a business process and innovation standpoint and lead and mentor the next generation of public servants.”

Schultz’s assignments over the years have ranged from several B-1 aircraft bed-down construction projects at Ellsworth Air Force Base to building Gen. Norman Schwarzkopf’s war room to creating and maintaining the main supply route across Saudi Arabia to repairing infrastructure in Kuwait City during Operation Desert Shield/Desert Storm.

While in Iraq and Kuwait, Schultz served with Dean Kattelmann, SDSU’s associate vice president of Facilities and Services.

“Mike was in charge of making sure I had all of the parts and pieces delivered on time so I could put together the pieces as I was in charge of the operational side of the house. Without his ability to plan the logistical side and make sure everything got there, we couldn’t have done it,” Kattelmann said. “We initially met at Leavenworth at the Command and General Staff College and then were both assigned to the same unit in Fort Lewis (Washington). He’s a great guy, a great friend.”

Schultz has also been part of the planning, programming, budgeting and execution of the Army’s largest construction effort since WWII as its Chief of Construction. He currently is the project executive for the Corps of Engineers construction efforts on the National Museum for the U.S. Army just outside of Washington, D.C.

“It’s been a very rewarding career so far not only delivering some very challenging facilities projects and programs, but more importantly also having had the opportunity to lead and be associated with many great teams of professionals across the U.S. Army and the Department of Defense,” Schultz said.

“It’s been a career I’ve never imagined, especially when it all started in a tank platoon in Germany as an armor officer,” he continued. “I remember telling myself as that assignment came to a close that I put a lot of effort into getting my civil engineering degree and I needed to make use of it. I transferred to the Army’s engineer branch, came back to the (United) States and carried that forward. It’s been a great career serving our nation and now that keeps going as this next chapter unfolds.”

Matt Schmidt
Marcia, of South Sioux City; four children, Molly (Alex) Castillo, Thomas (Sarah), Jonathan (WooJung) and Benjamin; two brothers, Thomas “Brad” (Michelle), and Tyler (Missy); and four grandchildren.

In lieu of flowers, offerings are being accepted to establish a Paul S. Prout Memorial on the grounds of South Dakota State.

DONALD VEAL, ’53 civil engineering, died Jan. 20, 2019, in Longmont, Colorado. Veal, who served as president of the University of Wyoming from 1981 to 1987, was honored by South Dakota State as a Distinguished Alumnus in 1983 and as a Distinguished Engineer in 2015.

After the Chance, South Dakota, native graduated from State, he entered the U.S. Air Force Pilot Training Program, was discharged in 1957, and began graduate school, first at State and then at the University of Wyoming.

While there, he taught in the civil engineering department and flew as a research pilot. He also flew for the U.S. Forest Service and gave private instruction, logging more than 11,000 hours in the cockpit.

Veal served the University of Wyoming in several capacities, including professor, assistant director of the Natural Resources Research Institute, the first head of the Department of Atmospheric Science, which he started and nurtured; vice president for research, and ultimately, president.

After nearly 30 years at the University of Wyoming, Veal retired to become president and chief executive officer of Particle Measuring Systems in Boulder, Colorado, a company that specializes in manufacturing instruments to optically observe small particles in various media. He held that position for eight years.

Veal received the Medallion Service Award from the University of Wyoming in 1990. He also is a member of the Wyoming Engineering and Wyoming Aviation halls of fame.

He was preceded in death by his wife, Bonita, in 2017.


Ceglian, 85, of Belle Fourche, was a 1959 mechanical engineering graduate of Purdue University and spent the next 16 years working in sales engineering and research and development. His responsibilities at SDSU included writing grant proposals and seeking funding to operate the South Dakota OSHA Workplace Safety Consultation Program.

He and wife, Cindi Penor-Ceglian (Sept. 1, 1979), lived at Lake Campbell until moving to Belle Fourche in 2011.

Survivors include his wife, two daughters, Amanda (Don) Norgaard, Brookings, and Sara (Troy) Anderson, Moorhead, Minnesota; and a son, Brandon (Anna) Ceglian, Highlands Ranch, Colorado.

PAUL PROUT, ’85 mechanical engineering, died Dec. 9, 2018, at his Grand Forks, North Dakota, home.

Prout, 55, was born March 24, 1963, in Sioux City, Iowa, and played fullback for the SDSU football team, lettering in 1982-84 as well as being a captain his senior year.

He was a partner and vice president of EAPC Architect Engineers, a five-state, 10-location firm based in Grand Forks. Prout also was head of the Industrial Services Division, where he made significant contributions during his 23-year career.

Survivors include his wife of 34 years, Jill; parents, Tom and Marcia, of South Sioux City; four children, Molly (Alex) Castillo, Thomas (Sarah), Jonathan (WooJung) and Benjamin; two brothers, Thomas “Brad” (Michelle), and Tyler (Missy); and four grandchildren.

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REUBEN FLESNER, ’07, mechanical engineering, has been promoted to design engineer manager at Climate by Design International, Owatonna, Minnesota.

He joined the engineering and manufacturing firm in October 2011 as an applications engineer, where he gained experience in the sales area. His work included numerous HVAC applications including hospital surgical suites and archival storage. He was promoted to senior design engineer in February 2017. As a senior design engineer for almost two years, he led several new product and design changes.

Climate by Design International supplies dehumidification and air handling products to the commercial and industrial marketplace for a wide array of applications including ice arenas, hospital surgical suites and food processing facilities.

KEN HELLEVANG, ’78/’79 was named interim chair of the Agricultural and Biosystems Engineering Department at North Dakota State University Feb. 15.

He joined the department in 1980 and is a nationally recognized expert in grain storage and drying, structural engineering and home moisture issues. He also is an NDSU Extension agricultural engineer and holds a doctorate from NDSU.

Pierre Mayor Steve Harding declared Feb. 27, 2019, as MANSOUR LINCOLN KARIM Day in Pierre. Karim, ’55/’61 civil engineering, migrated from Iran in 1950 with $27, enrolled at Huron College and then transferred to State to earn his bachelor’s and master’s degree before landing a $3,500 per year job with South Dakota Department of Transportation.

Through frugal living and wise real estate investments, he became a man of means and a well-known philanthropist. In 2011, Karim was named Pierre’s Philanthropist of the Year. Now 90 and a Pierre resident for 70 years, he will soon move to Rapid City to be closer to family members. He and his late wife, Ruth, had seven children.

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Survivors include his wife, two daughters, Amanda (Don) Norgaard, Brookings, and Sara (Troy) Anderson, Moorhead, Minnesota; and a son, Brandon (Anna) Ceglian, Highlands Ranch, Colorado.
Todd Letcher arrived on campus as a freshman in 2001 with several small scholarships and great ambition to be a mechanical engineer.

He had no problems pulling straight As at Aberdeen Central High School and that carried through his first semester. In spring semester 2002, “I was about to get my first B ever,” the assistant professor recalled. Looking back as an adult, that doesn’t seem like a tragedy. But as a 19-year-old, when he got a B in statics, “I’m thinking the world is over,” he said.

Earlier that spring he had interviewed for the Kevin Moe Scholarship, which at that time the 1988 computer science alum was awarding independently.

In June, Moe called to say he had been awarded the $1,500 renewable scholarship. Letcher had been wondering if he should switch majors. “When that came, I thought ‘I can’t stop now. I’ve got this really awesome thing.’ The world was crashing and then I got this good news,” Letcher said.

In the years that followed, Letcher would get a few more Bs (“None of them felt good”), but he never wavered in his dedication to mechanical engineering, graduating magna cum laude in 2005.

From there he went to The Ohio State University for a master’s and doctorate in mechanical engineering. He returned in 2012, first as a postdoctoral student, then as a lecturer and by the third year, an assistant professor. He teaches 2 different courses and has become the resident expert in 3D printing; currently working with students on the NASA 3D Printed Habitat Challenge.

“Having that money definitely made me a better student because I could go through college without another outside job or outside distraction. It allowed me to focus on my studies and get mostly As,” Letcher said.

FROM INTERN TO CHIEF TECH OFFICER

He was the second student to receive the Moe Scholarship.

The first was Tim Vanderham, the chief technology officer of NCR Corporation, the Atlanta-based global leader in consumer transaction technology. In January 1999, he was a student intern at IBM in Rochester, Minnesota, where Moe also worked.

He had already spent eight months there as an intern working with the software “LoadRunner,” which at the time was the industry benchmark for load testing and automated testing tools. His work was turning heads at IBM. “I not only did the scripting of the testing but also then helped debug the application and IBM product defects,” Vanderham said.

Among those he impressed was Moe, who was IBM’s lead recruiter at the time.

While he was not Vanderham’s direct supervisor, he did inspire Moe to start an excellence scholarship, Moe said. “When I went to State, there weren’t a lot of scholarships available to students with high GPA. I know what it meant to me to get a small scholarship,” said Moe, the valedictorian of his Hanson High School class.

“I always liked to see students who excelled. I have a lifelong passion for seeing students being able to achieve because they were financially able to go to school,” he said.

The scholarships Vanderham received initially had expired by the time he received the Moe Scholarship. “It was a great benefit to help me offset my tuition costs and allowed me to have reduced loans at the end of college,” he said.

Reflecting on the experience, Vanderham said, “It is an honor to have been the first recipient of the Moe Scholarship. As I have
met the following scholarship winners, it is an impressive group of extremely smart and successful people. I’m honored to be a member of the group.”

**SCHOLARSHIP JUMP-STARTED CAREER**

The most recent members of the group are Nicholas Wolter, a 2016 computer science graduate, and John Hedman, a senior computer science major.

Moe reached out to Wolter after meeting him at an industrial advisory board meeting when Moe was visiting campus. Their follow-up meeting was at 10:30 p.m. in the University Student Union. “We didn’t walk out until 10 after 12. I told an IBM manager, ‘Call this kid and don’t lose him.’”

Wolter said, “The scholarship started the first semester of my sophomore year, and I was able to receive it until my last semester on campus, which was the second semester of my junior year. After my junior year, I was only missing one class so I started a full-time software engineering job with IBM in Raleigh, North Carolina. While living in Raleigh, I finished that class and got my diploma in December 2016.

“The Kevin Moe Scholarship had a huge impact on my schooling as well as kick-starting my career through opening doors for internships.

“Because of the scholarship, I was able to really focus on my schooling during my sophomore year instead of worrying about working enough hours. That allowed me to take a larger course load, which led me to start a full-time job a whole year early. I know a year does not sound like a lot, but alongside giving me the chance to jump-start my career, it allowed me to save on whole year’s worth of schooling expense.”

In May 2017, he joined Teradata as a senior software engineer in Raleigh and earlier this year was asked by Vanderham to join the team at NCR.

**CANDLE TO BE PASSED ON**

Hedman, of Brandon, received the $2,000 Moe Scholarship at the start of his junior year (fall 2017). It wasn’t long after that (November) when Moe invited Hedman to apply for an internship at his current employer, KBRWyle, the civil contractor for EROS (Earth Resources Observation and Science Center) near Baltic.

Hedman works 10 hours a week out of an office in Daktronics Engineering Hall on campus. “Because of the scholarship, I don’t have to work as much,” he said.

After he graduates in May, he will begin working full time at EROS as a junior cloud software engineer. “I really like the cloud work we’re doing. A lot of it is generating code to push data up to the cloud and making sure the data is going the fastest way possible. There’s a lot of little pieces you have to write for each scenario and there is a lot of code to generate in order for the database to work in the cloud,” Hedman said.

The award will go to a new computer science major this fall. “I want it to be a three-year scholarship to one of the top underclassmen,” Moe said.

While Moe initially handled the scholarship independently, for a number of years now it has been handled through the SDSU Foundation, where he serves on its board of trustees. The award also evolved to become a computer science scholarship because of the need in that department.

“I have the income and means to do something. Watching strong upstart talent exceed beyond my expectation is hard to describe,” Moe said.

_Dave Graves_
Once again, South Dakota State University engineering students proved themselves No. 1 at building and racing a human-powered vehicle.

Driving into Texas to avoid a major blizzard on the High Plains, Associate Professor Gregory Michna and 10 students in the Department of Mechanical Engineering drove a van and a car 1,900 miles to Los Angeles for the March 15-17 E-Fest competition. The team left the afternoon of March 13 and arrived 35 hours later.

By the time the crew headed home March 17, it was hauling back trophies for design, men’s and women’s sprints, endurance and best overall entry.

Three weeks later, the team was on the road again, this time to East Lansing, Michigan, for E-Fest North. Competing against 49 other schools, including a handful outside of the United States, the SDSU entry finished third by placing third in design and women’s speed, fourth in men’s speed and second in endurance.

Named Quack Jack because the vehicle was equipped with a car horn that quacked like a duck, the South Dakota State entry is powered by pedals but designed much like a small race car. The body is composed of carbon fiber composite with a shrinkwrap windshield and windows. It is aerodynamically sound and weighs only 65 pounds.

The vehicle builds on the success of the school’s 2018 entry, which won regional competitions in Los Angeles and at Penn State, Michna said.

He said steering components were redesigned with carbon fiber rather than aluminum to make the vehicle lighter. Also, the roll cage and fairing were redesigned so a parcel could be placed inside the vehicle instead of hanging the parcel on the outside of the vehicle, Michna said.

AIDED BY ATHLETIC ENGINEERS

In the endurance event, a 2 ½-hour race, contestants try to complete as many 1.5-kilometer laps as possible. They have to negotiate speed bumps, rumble strips, slalom turns, a quick turn, the parcel pickup and drop off and, new this year, a hill climb.

“We had to come to a complete stop, climb a short, steep hill and stop at the bottom of the hill to prove braking ability. That had to be done every five laps,” Michna said.

The South Dakota State entry completed 34 laps, two laps ahead of second place.

SDSU used five different drivers and they were an athletic group of engineering students.

Senior Alex Gray, of Barrington, New Hampshire, is an endurance bike rider and served as the team captain. He was joined by four members of the Jackrabbits’ track and field team: distance runners Evan Fick, of Garretson, and Ray Munsterman, of Brookings; and middle distance runners Joshua Goehring, of Sioux Falls, and Anna Fasen, of Big Lake, Minnesota, all juniors.

The five nondriving participants were freshman Sara Broad, Lincoln, Nebraska; sophomore Evan Tebay, of Huron; junior Lane Prather, of Ida Grove, Iowa; senior and head mechanic Nicholas LaFave, Mission Hill; and junior Cole Brown, Sioux Falls.

All helped design and build the bike. At the races, which were held on the parking lots at Fairplex, home to Los Angeles County Fair, there was a lot of last-minute work to ready the bike, including fitting the fairing.

FASSEN REPEATS AS WOMEN’S CHAMP

Building Quack Jack took an estimated 1,000 manhours and included four students who didn’t make the cross-country trip to California. The frame and other parts were assembled in a lab in the Architecture, Mathematics and Engineering Building with the work divvied up among the future engineers.

The first day of the event, sponsored by the American Society of Mechanical Engineers, was for design judging and safety inspection. SDSU placed third in design.

The 280-meter sprint races were on Day Two. Both the men and women had the second-fastest qualifying times. Teams then faced off in a double-elimination bracket. Fasen was undefeated in repeating as the women’s winner. The men’s entry had three racers—Fick, Munsterman and Goehring—and had to come back through the consolation bracket, but prevailed on the legs of Goehring to twice beat Missouri Science and Technology.

“Once these students began planning for this spring’s competitions, their goal was to continue the tradition begun by the 2017-18 team,” Michna said.

Dave Graves
Apparently, Seth Friesen retained quite a bit of knowledge from this fall’s 3D printing class taught by Todd Letcher at South Dakota State University.

“We had several teams that built hovercrafts for class. My team had the best one, the one that was able to consistently pick up the payload,” said Friesen, a junior mechanical engineering major from Olivet. This spring he applied that knowledge to enter the IAM3D challenge at E-Fest, a large student engineering contest in Los Angeles suburb of Pomona, California, March 16.

Friesen, a 2016 graduate of Menno High School, outsmarted and outmaneuvered the other two teams to walk away with the $250 prize in the contest sponsored by the American Society of Mechanical Engineers.

Friesen was a team of one. His classmates were unable to attend. The other two teams had 10 and 15 members.

With no concerns about delegating duties, Friesen maneuvered his hovercraft through a maze, picked up a payload, delivered it to a different location within the maze and then parked his hovercraft in a third location. The timed event was held inside on a concrete floor with the hovercraft creating its own airlift.

It was powered by five motors that activated propellers that spun at 28,000 revolutions per minute and created differential thrust that Friesen programmed with the remote and electronic speed controls. The hovercraft was 18 inches long by 7.65 inches wide with a 6-inch claw. The claw was used to grab the payload, a 2-inch cube.

He purchased the motors and remote control units. Friesen used a campus 3D printer and two of his own 3D printers to build the hull of the hovercraft, the turbine tunnels, the motor mounts and the gear/claw system. Contestants were also required to use a computer program to design the parts and submit a design report containing statistics and calculations.

Prior to taking Letcher’s class, Friesen had experience making 3D objects on his father’s 3D printer, but no experience with design, remote controls or programming.

“I knew how to take a tractor apart and put it back together, but this was all new to me,” the farm boy said.

The hovercraft he built for the Innovative Additive Manufacturing 3D Challenge was an entirely new creation from his classroom project, except for the motor and electronic speed controller. He took those off the classroom hovercraft because the parts he ordered didn’t arrive before leaving by vehicle with 10 other engineering students for the two-day drive to L.A.

Getting the craft built on time was his biggest challenge, he said.

“It was pretty much a scramble to finish it. But I was able to test it. I’m pretty happy with how the entire hovercraft turned out, especially since this was my first time going to E-Fest,” he said.

Dave Graves
ENROLLMENTS BY DEGREE (FALL 2018)

UNDERGRADUATE MAJORS (FALL 2018)  
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MASTER OF SCIENCE MAJORS (FALL 2018)  
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</tr>
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DOCTORAL MAJORS (FALL 2018)  
<table>
<thead>
<tr>
<th>MAJOR</th>
<th>FEMALE</th>
<th>MALE</th>
<th>TOTAL</th>
<th>PERCENT*</th>
</tr>
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<tbody>
<tr>
<td>Ag/ Biosystems/Mechanical Engineering</td>
<td>4</td>
<td>8</td>
<td>12</td>
<td>20.7</td>
</tr>
<tr>
<td>Civil &amp; Environmental Engineering</td>
<td>2</td>
<td>9</td>
<td>11</td>
<td>19</td>
</tr>
<tr>
<td>Computational Science &amp; Statistics</td>
<td>5</td>
<td>7</td>
<td>12</td>
<td>20.7</td>
</tr>
<tr>
<td>Electrical Engineering</td>
<td>2</td>
<td>21</td>
<td>23</td>
<td>39.7</td>
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<td><strong>TOTAL</strong></td>
<td>13</td>
<td>45</td>
<td>58</td>
<td>100.00</td>
</tr>
</tbody>
</table>

**Note: There is some duplication because of students that have more than one program in the same college and totals might not equal 100 percent due to rounding.**

**Includes Math, Math with Data Science Specialization and Math with Teaching Specialization**

<table>
<thead>
<tr>
<th>COMPARSED TO</th>
<th>FEMALE</th>
<th>MALE</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total 2017*</td>
<td>205</td>
<td>1397</td>
<td>1602</td>
</tr>
<tr>
<td>Total 2016*</td>
<td>221</td>
<td>1431</td>
<td>1652</td>
</tr>
<tr>
<td>Total 2015*</td>
<td>186</td>
<td>1311</td>
<td>1497</td>
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<tr>
<td>Total 2014*</td>
<td>199</td>
<td>1271</td>
<td>1470</td>
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</table>

<table>
<thead>
<tr>
<th>COMPARSED TO</th>
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<th>MALE</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total 2017*</td>
<td>64</td>
<td>205</td>
<td>269</td>
</tr>
<tr>
<td>Total 2016*</td>
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<tr>
<td>Total 2015*</td>
<td>60</td>
<td>183</td>
<td>243</td>
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<tr>
<td>Total 2014*</td>
<td>68</td>
<td>202</td>
<td>270</td>
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DEGREES CONFERRED (2018-19)

UNDERGRADUATES (7-1-17 TO 6-30-18)  
<table>
<thead>
<tr>
<th>Major</th>
<th>Female</th>
<th>Male</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ag &amp; Biosystems Engineering</td>
<td>2</td>
<td>20</td>
<td>22</td>
</tr>
<tr>
<td>Civil Engineering</td>
<td>10</td>
<td>40</td>
<td>50</td>
</tr>
<tr>
<td>Construction Management</td>
<td>7</td>
<td>36</td>
<td>43</td>
</tr>
<tr>
<td>Computer Science</td>
<td>3</td>
<td>27</td>
<td>30</td>
</tr>
<tr>
<td>Electrical Engineering</td>
<td>1</td>
<td>24</td>
<td>25</td>
</tr>
<tr>
<td>Electronics Engineering Technology</td>
<td>0</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>Mathematics &amp; Statistics</td>
<td>9</td>
<td>11</td>
<td>20</td>
</tr>
<tr>
<td>Mechanical Engineering</td>
<td>10</td>
<td>66</td>
<td>76</td>
</tr>
<tr>
<td>Operations Management</td>
<td>1</td>
<td>11</td>
<td>12</td>
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<tr>
<td><strong>Total</strong></td>
<td><strong>43</strong></td>
<td><strong>241</strong></td>
<td><strong>284</strong></td>
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</table>

PERCENT CHANGE
- Fall 2015: 179  39.8%
- Fall 2016: 230  28.5%
- Fall 2017: 213  -7.4%
- Fall 2018: 186  -12.7%

FEMALE MALE TOTAL
<table>
<thead>
<tr>
<th>Major</th>
<th>Female</th>
<th>Male</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ag &amp; Biosystems Engineering</td>
<td>2</td>
<td>5</td>
<td>7</td>
</tr>
<tr>
<td>Civil Engineering</td>
<td>3</td>
<td>16</td>
<td>19</td>
</tr>
<tr>
<td>Computer Science</td>
<td>4</td>
<td>5</td>
<td>9</td>
</tr>
<tr>
<td>Data Science</td>
<td>6</td>
<td>19</td>
<td>25</td>
</tr>
<tr>
<td>Electrical Engineering</td>
<td>6</td>
<td>12</td>
<td>18</td>
</tr>
<tr>
<td>Engineering (MEng)</td>
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<td>4</td>
</tr>
<tr>
<td>Mathematics</td>
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<td>2</td>
</tr>
<tr>
<td>Mathematics-statistics</td>
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<td>1</td>
<td>4</td>
</tr>
<tr>
<td>Mechanical Engineering</td>
<td>1</td>
<td>12</td>
<td>13</td>
</tr>
<tr>
<td>Operations Management</td>
<td>2</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>Statistics</td>
<td>4</td>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>31</strong></td>
<td><strong>81</strong></td>
<td><strong>112</strong></td>
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</table>

DOCTORAL MAJORS  
<table>
<thead>
<tr>
<th>Major</th>
<th>Female</th>
<th>Male</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ag &amp; Biosystems &amp; Mechanical</td>
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<td>Computational Science/Statistics</td>
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<tr>
<td>Electrical Engineering</td>
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<td>1</td>
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<tr>
<td><strong>Total</strong></td>
<td><strong>4</strong></td>
<td><strong>12</strong></td>
<td><strong>16</strong></td>
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</tbody>
</table>

OTHER STATISTICS

JACKRABBIT GUARANTEE SCHOLARSHIP RECIPIENTS 2018-2019
- First Year: $516,600  205
- Second Year: $337,500  139
- Third Year: $314,750  120
- Fourth Year: $189,338  84
- **Total:** $1,358,188  548

Average award per year: $2,478

COLLEGE OF ENGINEERING FACILITIES
<table>
<thead>
<tr>
<th>Building</th>
<th>SQ. FT.</th>
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</thead>
<tbody>
<tr>
<td>Agricultural Engineering</td>
<td>48,696</td>
</tr>
<tr>
<td>Crothers Engineering Hall</td>
<td>89,960</td>
</tr>
<tr>
<td>Daktronics Engineering</td>
<td>73,464</td>
</tr>
<tr>
<td>Solberg Hall</td>
<td>55,735</td>
</tr>
<tr>
<td>Architecture, Mathematics &amp; Engineering Building</td>
<td>62,000</td>
</tr>
<tr>
<td>Raven Precision Agriculture Center (work to begin soon)</td>
<td>129,000</td>
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COLLEGE OF ENGINEERING EXTERNAL FUNDING

INTERNATIONAL UNDERGRADUATE STUDENTS  
<table>
<thead>
<tr>
<th>Fall</th>
<th>Number</th>
<th>Percent Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>2015</td>
<td>179</td>
<td>39.8%</td>
</tr>
<tr>
<td>2016</td>
<td>230</td>
<td>28.5%</td>
</tr>
<tr>
<td>2017</td>
<td>213</td>
<td>-7.4%</td>
</tr>
<tr>
<td>2018</td>
<td>186</td>
<td>-12.7%</td>
</tr>
</tbody>
</table>

COE External Funding w/o Earmarks  
- 2000: $0  
- 2002: $0  
- 2004: $0  
- 2006: $0  
- 2008: $0  
- 2010: $0  
- 2012: $0  
- 2014: $0  
- 2016: $0  
- 2018: $0

COE External Funding  
- 2000: $0  
- 2002: $0  
- 2004: $0  
- 2006: $0  
- 2008: $0  
- 2010: $0  
- 2012: $0  
- 2014: $0  
- 2016: $0  
- 2018: $0

Expenditures  
- 2000: $0  
- 2002: $0  
- 2004: $0  
- 2006: $0  
- 2008: $0  
- 2010: $0  
- 2012: $0  
- 2014: $0  
- 2016: $0  
- 2018: $0

Linear COE External Funding w/o Earmarks  
- 2000: $0  
- 2002: $0  
- 2004: $0  
- 2006: $0  
- 2008: $0  
- 2010: $0  
- 2012: $0  
- 2014: $0  
- 2016: $0  
- 2018: $0
DEAN'S CLUB
FROM JAN. 1, 2018, TO DEC. 31, 2018

Dean's Club membership consists of alumni and friends who have contributed $500 or more annually to the Jerome J. Lohr College of Engineering. Dean’s Club members are recognized as devoted friends of the college who make a significant impact on the college’s future. They also will receive invitations to special college and university functions and updates from the dean.

$1,000 AND ABOVE
3M - Brookings
3M - Matching Gifts
AGCO Corporation
Agtegra Cooperative
Alyn Holt Estate
Timothy T. Amert
Norman A. Andenas and Cecelia M. Wittmayer
Roderick B. Anderson
ASME - Nebraska Section
Associated Consulting Engineering Inc.
Associated General Contractors of SD-Building Chapter
Avera Health
Gladys Bahnson
Ball Corporation
Gladys Bahnson
Banner Associates Inc.
Ball Corporation
GE Healthcare
Banner Health
Barbara H. Bardos
Brosz Engineering Inc.
Brookings Municipal Utilities
Darin L. Brickman
Duane D. Boice
Michael Mulligan and Lori Bocklund
Gary L. Bliss
Gayland J. and Carolyn Bender
Guy J. Bender
Jay T. Bender
Justin Benson
Richard A. and Beth E. Berreth
Paul C. and Jessica Bezdicek
Kelly L. Biddle
Dan J. and Donna Bierschbach
Black Hills Utilities Holdings LLC
Charles N. Blackman
Blackman-Helseth Family Foundation
Francis M. and Beverly A. Blaze
Gary L. Bliss
Michael Muhligan and Lori Bocklund
Boeing
Duane D. Boice
Darin L. Brickman
Brookings Municipal Utilities
Brosz Engineering Inc.
Jon R. and Wendy A. Brown
Trent and Nicole Bruce
Michael A. Bucher
Tim H. and Suzette R. Burckhard
Burns and McDonnell
Ed and Judy Cannon
Daniel and Tongsai Chase
Robert J. Cheever
David A. and Mary Jo Christensen
Gregg A. Christiansen
David E. and Barbara A. Christianson
CHS Farmers Alliance
Richard A. and Eleanor J. Coddington
Kurt D. and Mary Cogswell
Kerry John McNellis
Crowned Ridge Wind I LLC
Daktronics Inc.
Bryce J. and Jayne C. Pickart
Larry D. De Mers
Glenn DeGroot
Arlo B. and Barbara DeKraai
Max M. and Marilyn R. DeLong
Cheri A. DeSmet
Benjamin M. Devine
Jason L. and Jodi L. Devine
DGR Engineering
Curtis D. Dieren
Scott A. Dooley
Maxine F. Dornbush
Dow Corning Corporation
Neal D. Drefke
East River Electric Power Cooperative Inc.
Eastern Chapter South Dakota Engineering Society
Edinger Brothers Partnership
James O. Edwards Jr. and Rita M. Edwards
Robert K. and Judith L. Egan
Electrical Consultants Inc.
Thomas D. Elverson
Eugene B. Frykman Estate
Stephen M. Everson
ExxonMobil Foundation
Falcon Plastics Inc.
Harold C. and Eleanor H. Falk
Adolph and Erika Fejar
Joseph M. Fergen
Andre J. and Mary Ann Fischbach
Daniel L. Raap and Julie K. Forster
David M. and Shelley R. Frazee
Matthew J. Fritz
Full Circle Ag
Gage Brothers Concrete
William L. Gamble
Jason L. and Jessica A. Garder
Jerome J. and Olimpia Gaspar
Ned and Jenny Gavlick
GE Fund
Glenn S. and Janice C. Gehring
Marlin H. and Shirley K. Golnitz
Daniel J. Graber
Graco Foundation
Grand Electric Cooperative
Great Northern Environmental
Richard L. Gunderson
Philip L. and Kristin J. Gundvaldson
Justin C. and Jallyn Guthmiller
Dale A. and Barbara A. Haack
Bruce G. Haag
Kurt L. and Dori Hansen
Seth T. and Ann M. Hansen
Sharon Hansen
Randy W. Hanson
Michael R. Harms
Harold C. Hohbach Estate
Wayne R. and Karla K. Haug
HDR Engineering Inc.
Heartland Consumers Power District
Jerome D. Heeren
Allen D. and Roxanne Heiden
Richard L. Heiden
Michael R. Heier
Duane C. Helmerberger
James A. and Sandra L. Hembd
Henry Carlson Construction LLC
Brian L. Hoellein
Wallace J. Hoff Jr.
Larry G. and Darlaine J. Hoffman
Harold C. Hohbach Estate
Alryn R. Holt Estate
Hormel Foods Corporation
Burton and Gladys Horsted
Scott L. and Mary B. Hoscheid
HVAC Elements
IBM - New York
IBM Corporation
Jeffrey L. Ihnen
Ingevity Corporation
ISG
Roger N. Iverson
Roy L. Jackson
Dale A. and Diane Jans
Ronald R. Jarrett
Deloris E. Jensen
Peter S. Johnson
Dean H. Johnson
Thomas G. and DeeDee Josten
John G. Kappenman
Daniel R. and Nancy K. Kenyon
James F. Kirby
Audrey Knofczynski
John A. and Leah L. Knofczynski
Kyle C. Koch
Kolberg-Pioneer Inc.
Daren A. and Teresa C. Konda
Heidi Konynenbelt
Andrew D. and Kayla V. Koob
Kristine H. Sanders Estate
Matthew J. and Melissa Kurtenbach
Reece A. and Kami L. Kurtenbach
Aelred J. and Irene Kurtenbach
David L. and LaVonne I. Kurtz
John A. LaBrie
Susan A. Lahr and Gordon D. Niwa
Darrell D. and Vicki K. Larson
Carl E. and Carol C. Larson
Craig A. Larson
Ronald J. and Bettie LaVallee
Ralph E. Lindner
Link Manufacturing Ltd.
Mary Jo Little
Jerome J. and Jolene M. Lohr
Bruce C. and Gloria Lutz
Sue E. Mabee
Arden V. Mackenthun
John M. Madden
Malloy Electric
Eleanor Engels
James (Jim) L. Mann
Richard J. and Mary P. Mattern
Michelle L. McCarville
Richard L. and Karen A. McComish
Duane L. and Nancy McDonnel
James W. and Jo Ann F. Mentelle
Troy W. and Gwen Metzger
Blair A. and Julie Metzger
Brian D. and Ruth A. Meyer
Michaels Energy
Dennis B. and La Donna Micko
Microsoft Corporation
Mid States Electric Co. Inc.
MidAmerican Energy Company
Glen D. Middleton
Midwestern Mechanical Inc.
Tanya L. and Timothy D. Miller
Joy E. and John H. Mills
Mills Construction Inc.
MinneAnalytics
Minnesota Power
Missouri River Energy Services
Mitchell Manufacturing LLC
Kevin L. Moe
Susan L. Moe and Vaughn K. Jensen
James B. and Dorothy A. Morgan
James J. and Irene Mullen
National Electrical Contractors Association Inc.
MORE THAN TEACHING

If you think back to your days as a student, you probably may recall several teachers you remember as “good” teachers that were skilled at making their class fun and engaging. There is no doubt that teachers work hard to connect with their students and find effective ways to instruct them on the core elements of their subject.

However, with all of the teachers you have had in the past, I’ll wager there are a couple who spark a deeper, more emotional reaction. These are the teachers who supported, mentored and guided you during critical times in your life and had a much greater impact. In my case, it was my fifth-grade English teacher (who was also my Little League Baseball coach) and a professor in agricultural engineering at SDSU. English was not my strong suit in school and even though I loved baseball, my confidence as a player was lacking. This teacher was our biggest fan in the classroom and on the diamond. I did not realize it at the time, but his supportive words compelled me to succeed in both English and baseball. I remember fifth grade as one of the best years in school and the summer was amazing.

Several years later, while in my junior and senior years of college, I had classes from a professor whose passion and joy helped me in many ways. This professor wanted to know us as individuals and not simple students taking a class. As an undergrad, I worked on his research and saw how engineering can be applied to solve real-world problems. I may never quantify the full effect these teachers had on my life, but there is no doubt in my mind they had a positive and permanent impact on my life.

In the years since, I have often drawn on the impact these teachers made on my life. The value of their influence on students is impossible to measure and most teachers are not even aware they have made such a great difference. Over their careers, the impact of great faculty at SDSU, has, without a doubt, changed the world. Every day, great faculty members inspire students to great careers, research, inventions, new companies and growth that improves our world.

Faculty at SDSU and the Jerome J. Lohr College of Engineering need resources to teach, research, challenge and inspire our students in new and engaging ways. As with the new buildings added in the recent years, the traditional sources to support their efforts are not enough and private support can really make a big difference. There are many ways you can help the Lohr College of Engineering recruit and retain great faculty who will impact current and future students.

Your support could have the dual impact of providing resources for our current faculty and could also honor a professor who had a significant impact on your college experience and beyond. I welcome the opportunity to learn about your experiences with an impactful faculty member in your life and find ways you can help this memory continue.
One-Life Charitable Gift Annuity
Rates and Deductions:
(per $25,000 contributed)

<table>
<thead>
<tr>
<th>AGE</th>
<th>PAYOUT RATE PERCENTAGE</th>
<th>DEDUCTION (3.4% AFR)</th>
</tr>
</thead>
<tbody>
<tr>
<td>65</td>
<td>5.1%</td>
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</tr>
<tr>
<td>70</td>
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<td>75</td>
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<td>80</td>
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<td>85</td>
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<td>$13,943</td>
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<tr>
<td>90+</td>
<td>9.5%</td>
<td>$15,547</td>
</tr>
</tbody>
</table>

Deductions assume quarterly payments. Payout rates as of July 1, 2018. Subject to change. 2-life and deferred payment options also available.

Benefits Include:
- Payments backed by the SDSU Foundation
- Quarterly Life Payments
- Income Tax Deduction for Itemizers
- Deferred Payment Option (higher rates)
- Bypass Capital Gains Taxes
- Simple Application and Contract
- May gift cash or stocks

For more information, please contact:
SDSU Foundation Office of Gift Planning
1-888-747-7378 (toll-free)
www.sdstatelegacy.org
Bolting members of a steel bridge together are South Dakota State University team members, from left, Matthew Hoffman, Justin Goosen and Matthew Harris, far right. In the background are the other two members, Matthew Heikens, standing, and Tyler Tetrault, bending. State finished second out of eight Midwestern teams to qualify for nationals May 31-June 1 in Carbondale, Illinois.