New placement figures for the South Dakota School of Mines & Technology show 98 percent of 2014-15 graduates have secured employment with an average starting salary of $63,503 or are pursuing graduate degrees. Ten of the 16 majors had 100 percent placement rates, with the vast majority of students electing to go directly into industry, working at Google, Microsoft, Medtronic, NASA, SpaceX and more.

“We are very pleased that, in spite of the softness in hiring in the energy and mining sectors this year, 98 percent of our most recent graduates have successfully started their professional lives,” said Heather Wilson, president of the School of Mines. “As a university, we judge ourselves not by whom we exclude, but by whom we include and their success. This has been another good year for Mines.”

Almost 40 percent of graduates are staying in South Dakota, to continue advanced studies or contribute to the economic development of the state. Mines graduates are working for 56 different employers in 18 communities throughout South Dakota. South Dakota also led the way in employing Mines interns last year, with students working for more than 75 employers from 16 communities across the state.

Increasingly, universities like Mines are becoming important for economic development. As an exceptional engineering and science school with a lot of personal attention for undergraduate students, SD Mines is now attracting about half of its student body from out of state. In recent years, about 20 percent of the students who come from out-of-state have a first zip code after graduation inside South Dakota.

“South Dakota is one of the only states that actually grew manufacturing jobs all the way through the recession and unemployment is very low,” said Wilson. “One of the ways to continue to develop our economy is to attract talented young people to our universities and work with industry to connect them to internships and great jobs. Some of them will stay after they graduate.”

Mines’ successful placement rate and high salaries came to national attention starting in 2012 when an article in Forbes pointed out that SD Mines graduates “crush Harvard on pay.”

Mines grads continue to have higher starting salaries and better placement rates than every Ivy League school.

Chemical engineering graduates top the list in starting salaries, with offers averaging over $71,000, about $2,000 above the national average for that major. Mining engineering graduates were next at $69,800 in offered salaries, $4,000 above the national average. Metallurgical engineering graduates earned the third highest average salaries of $68,000, almost $6,000 above the national average for those majors.

On the cover: Mines student Dalton Kuehl interned with Bobcat Company in Bismarck, N.D., on the research and development team, working on a prototype mule.

Pictured above: David Christian landed a full-time job at Polaris in its Engineering Development Program after interning for the company.
Mines Awarded $750,000 to Develop Power System for Space Missions

SD Mines has been awarded $750,000 to develop an extreme biological system to turn solid waste into a power source for long-term space missions.

The NASA EPSCoR award builds upon earlier waste conversion concepts developed through Venkataramana Gadhamshetty’s research. Earlier this year, Gadhamshetty, Ph.D., P.E., BCEE., and his research team announced it had converted discarded tomatoes into electricity.

There is a critical need for a similar product for NASA, where long-term, manned space missions are challenged by waste treatment and power requirements. During space missions, each crew member typically generates 3.6 pounds of solid waste from biodegradable and non-biodegradable sources daily.

This voluminous waste is a burden to space missions, as it increases fuel consumption and may create nuisance and health concerns due to the pathogens. The SD Mines approach will use unique microorganisms isolated from the deep levels of the Sanford Underground Research Facility (SURF) in Lead as test subjects to develop an advanced biological module that uses electrochemistry principles, operates at thermophilic conditions and generates electric power from solid wastes in a single step.

The project will result in an efficient alternative to the current processes using chemical fuel cells, such as hydrogen fuel cells that require pure chemicals.

“These SURF extremophiles are known to survive harsh environments typical to extraterrestrial space, where it is seemingly uninhabitable. The extremophile biology provides a platform for provocative research to develop bio-modules to generate electricity from solid form of wastes, inhibit pathogens in human waste and recycle the waste during space missions,” said Gadhamshetty of the Department of Civil & Environmental Engineering.

A group led by Rajesh Sani, Ph.D., from SD Mines’ Department of Chemical & Biological Engineering, have isolated the SURF extremophiles.

“Using organisms that adapted to survive in one of the more extreme environments on earth to advance science for space travel is a novel concept. I’m glad NASA is interested and willing to support this work,” said SD Mines President Heather Wilson.

Researchers will collaborate with experts at Argonne National Laboratory and Navy Research Laboratory and throughout industry to develop a stacked bioelectrochemical module that supports low-powered electronics, including a Mars microrover. Resources from NASA’s Jet Propulsion Laboratory, Kennedy Space Center and Ames Research Center will also be used.

The project addresses prime areas identified for research and economic development in the state – energy and environment, value-added agriculture and agribusiness, and materials and advanced manufacturing.
Engineering students from the South Dakota Mines and business students from Black Hills State University are partnering on an aviation project to develop technology and prepare a business plan to meet new FAA safety requirements at lower cost.

The presidents from the longtime rival schools, both general aviation pilots with light aircraft, are challenging students to develop an affordable version of air-tracking technology known as ADS-B (Automatic Dependent Surveillance-Broadcast) that will be required by the Federal Aviation Administration in 2020.

Black Hills State University in Spearfish, led by President Tom Jackson, Jr., is a comprehensive liberal arts university with an internationally recognized business program, and South Dakota Mines in Rapid City, led by President Heather Wilson, is a top-ranked engineering and science university. Jackson flies a Grumman Cheetah. Wilson owns a Cessna 152.

Faculty members from the two campuses have already been collaborating. Next fall Black Hills State business students and SD Mines engineering students will team up on a senior design project to build and test an ADS-B system that complies with the technical requirements set out by the FAA at a significantly lower cost than currently on the market.

“President Jackson asked me if I thought that innovative engineers from Mines might collaborate with business students at BHSU to meet a safety need at a more reasonable price for the general aviation community,” said Wilson. “It sounded like an interesting project and worth a try.”

The BHSU business administration, professional accountancy, and MBA programs are accredited by the Association to Advance Collegiate Schools of Business (AACSB). Less than 5 percent of the business schools in the world are accredited by AACSB. This accreditation is considered the “gold standard” in terms of business school accreditations.

“We’re linking the knowledge of our students at BHSU with students at Mines and challenging them to solve a problem together, a problem with awesome potential in the aviation industry,” said Jackson, president of BHSU. “We’re looking forward to seeing the results of this collaboration.”

On the technical side, Scott Rausch, acting head of SD Mines’ Department of Electrical & Computer Engineering, is a former engineer for avionics manufacturer Rockwell Collins. Avionics and antennas are a strength of the electrical engineering program. This project will use the department’s new flight simulator for testing and integration of the ADS-B system.

Rausch is also a private pilot and prior owner of a Grumman Tiger airplane.

Wilson and Jackson may fly the equipment as part of the test program. Aircraft currently are required to have transponders in some busier airspace so that air traffic control can see them. This new technology will allow aircraft to “see” each other in the air, a major safety advancement. It would be similar to vehicle navigation systems that visually show all the other cars on the road as well as all of the weather up ahead. The project will try to significantly reduce the cost of a compliant, reliable system.

“This joint project addresses a real industry and consumer need and draws on the strengths of the two universities. It’s a great opportunity for planting the seeds of entrepreneurship in the Black Hills,” said Darren Haar, an entrepreneur-in-residence at the School of Mines who helps to drive technology developed at Mines into the marketplace.
Brickey Awarded $300,000 Grant in Effort to Rebuild U.S. Mining Faculty

Andrea Brickey, Ph.D., has been awarded the 2016 Freeport-McMoRan Career Development Grant, a $300,000 award focusing on rebuilding the faculty pipeline in U.S. mining schools.

The grant is part of the Academic Career Development initiative of the Society for Mining, Metallurgy & Exploration Inc. (SME) and the SME Foundation to boost viable tenure-track candidates in mining engineering, mineral processing or extractive metallurgy. Brickey is an associate professor at Mines.

Brickey's award is worth $100,000 per year for three years and will primarily fund two graduate students to assist in her research on “Production Schedule Optimization for Underground Mining,” which addresses processes, efficiencies and safety of mining projects. Additionally, the award will fund several undergraduate students and pay for travel for professional development opportunities, all of which is intended to support tenure and promotion.

“Dr. Brickey has been a tremendous addition to our faculty, and we very much appreciate the support of SME to help develop the next generation of top notch faculty in mining,” said Heather Wilson, Mines president.

Brickey earned her bachelor’s degree from South Dakota Mines in 1999 and worked for 15 years before returning to academia, earning her doctorate from Colorado School of Mines and then joining the SD Mines faculty ranks last fall. Her industry experience has focused primarily on mining operations and consulting projects in Africa and North and South America, mining copper, gold, silver, nickel, phosphate and coal.

As a doctoral student, Brickey was awarded the Seeley W. Mudd Memorial Fellowship, the predecessor to the SME Ph.D. Fellowship Grant also announced this week. Brickey is associate editor for the professional publication Mining Engineering and is a member of the SME Professional Engineer Exam Committee.

According to the SME, viable tenure-track faculty candidates are in decline at universities offering degrees in mining engineering, mineral processing or extractive metallurgy.

Intern Spotlight

Ezra Klein
Rockwell Collins

Assigned to the Air Nav team in the Government Systems Department, sophomore electrical engineering student Ezra Klein is working on a tactical air navigation system used by nearly all military aircraft, including helicopters and the space shuttle. A Thief River Falls, Minn., native, Klein most recently has been working on a new feature that will allow aircraft to triangulate their position, providing an alternative to GPS-based systems. Outside of work, this avid flight enthusiast has enjoyed flying in his paramotor, a motorized steerable paraglider.
From 8:30 a.m.-2 p.m. Saturday, July 9, Mines will host interactive science and engineering activities as part of the annual Neutrino Day science festival hosted by the Sanford Underground Research Facility located in Lead. All events are free and open to the public.

Faculty and students are involved in five high-level research projects a mile underground including the next-generation search for dark matter, cutting-edge research in neutrino and particle physics, radon-mitigation efforts, astrophysics-based research on solar neutrino sources and copper electroforming.

Mines faculty and students will also showcase the Formula racing vehicle conduct interactive experiments designed for all ages, such as gold panning and Geiger counter activities and make liquid nitrogen root beer floats. For a complete list of events, visit here.

The South Dakota School of Mines & Technology has received a $10,000 grant from State Farm to support its Women in Science & Engineering (WiSE) Center and programming along with Mines high school summer camps. The State Farm and WiSE relationship will also result in joint programming aimed at equipping women students with real-life skills, such as financial literacy. State Farm chose Mines because of the commitment State Farm has to supporting educational opportunity and providing students a greater chance to earn engineering and science degrees.

WiSE has made demonstrated gains in this objective, beginning with a 6 percent increase in women over three years through a mentorship program in mechanical engineering—a success that prompted the program to launch campus-wide starting Fall 2014. Last year marked the new establishment of a WiSE Center on campus, the first of its kind among South Dakota universities.

One year into the campus-wide mentorship program, first-time freshmen female students, which had been down in fall 2014, increased by over 8 percent for fall 2015. In addition, first-time female freshmen retention remained at 81 percent.

Matching freshmen women students with upper-class mentors is just one WiSE offering. Other programming includes coffee talks with alumni and industry partners, an annual industry panel dinner, an outreach conference and other professional development and outreach events. The Center itself allows for increased student collaboration and serves as a gathering place where students can study, participate in team-based learning and network with faculty.
SD Mines research scientist Andrea Surovek, Ph.D., has been named the recipient of the 2016 George Winter Award by the Structural Engineering Institute (SEI) of the American Society of Civil Engineers (ASCE). The award recognizes a structural engineer who best typifies the late George Winter's humanistic approach to the profession: an equal concern for matters technical and social, art and science, soul and intellect. Surovek joins a short list of internationally known structural engineers who have significantly advanced the state-of-the-art in structural engineering and demonstrated a commitment to the artistic needs in the community through work not directly related to engineering and science.

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The Direct Analysis Method for stability design of steel frame structures based on Surovek’s work has become codified as the preferred method for stability assessment in the U.S. specification for the design of steel buildings (ANSI/AISC 360). She co-authored Structural Stability of Steel: Concepts and Applications for Structural Engineers, is an ASCE/SEI Fellow and has authored more than 60 publications.

Surovek has held numerous leadership positions in professional societies, overseeing eight technical committees of ASCE/SEI as the chair of the Metals Administrative Committee and serving two terms on the Executive Committee of the Structural Stability Research Council, the only woman to serve in that capacity in the organization's 70-year history. She is also an Associate Editor of the Journal of Structural Engineering and recently developed and will chair a new technical committee for ASCE on bioinspired structures.

Along with a Ph.D. in engineering, Surovek holds a B.A. in theatre and recently returned to acting in local productions. Committed to the arts, Surovek is also the founding director of Music Adds Up, a nonprofit focused on supporting elementary school music education, recognizing the beneficial influence that music has on the development of mathematics and scientific skills. Music Adds Up recently awarded its first classroom and professional development grants to four elementary music teachers in Rapid City to support purchases of music library resources and instruments that improve accessibility to disabled students. Professional development grants will fund educator travel to workshops and conferences.

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SPS Sheds Light on Dark Matter at SoDak Con

The Society of Physics Students presented the panel “Shedding Light on Dark Matter and Dark Energy” at SoDak Con to a packed crowd in the Civic Center June 24th.
This summer, South Dakota Mines ROTC students join thousands of Army cadets from around the nation, Guam and Puerto Rico to undergo Cadet Summer Training (CST) in far-flung places like the Congo. Summer drills includes Cadet Initial Early Training, Cultural Understanding and Language Proficiency (CULP), Cadet Leadership Camp (CLC), Army Airborne and Air Assault schools and internships.

During Cadet Initial Early Training, freshmen mechanical engineer Taylor Topping will travel to Fort Knox, Ky., to learn water survival techniques; how to care for, maintain and fire various weapon systems; rappel off of a structure; and operate in a tactical environment with a team.

Other South Dakota School of Mines & Technology students will trek to two continents, alongside CULP participants traveling to 28 countries. Sophomore civil engineer Derek Merchen will travel to the Democratic Republic of Congo; freshman civil engineer Bradley Ware, to Germany; and junior mechanical engineer Justin Gelling, to Malawi.

Cadets will also prep for Cadet Leadership Camp, training in tactics, adaptive leadership and ethical decision-making in the most grueling 30-day course

the U.S. Army Cadet Command offers, designed to push cadets to their limits while placing them in leadership roles.

Following wilderness combat training, fresh from Malawi cadet Gelling will join junior mechanical engineers Carson Purcell and Samuel Wendte and Mines military science minor Brianna Barkley in traveling to Fort Knox for missions, ambushes, attacks and raids. The camp is a culmination of three years of on-campus training.

Having earned enough merit to attend an Army school outside of Cadet Command, freshman civil engineer Matthew Greenfield will spend his summer at the U.S. Army Air Assault School at Fort Benning, Ga., learning how to sling load equipment and rappel various types of rotatory wing aircraft.

Mines cadets will finish their training in real-world internships. Wendte has earned one in Philadelphia, Pa., while senior mechanical engineer Bryan Lupton's is in Albuquerque, N.M., both with the U.S. Army Corps of Engineers. Barkley will undertake a medical internship at Brook Army Medical Center in San Antonio, Texas.
The South Dakota School of Mines & Technology will host researchers from India for a year-long collaborative bioprocessing study on extremophiles found deep underground, which could lead to the development of efficient and cost-effective green technologies.

An in-depth understanding of organisms living in such extreme environments as those a mile below the earth's surface at the Sanford Underground Research Facility will help scientists convert solid wastes to bioenergy.

The Sanford Lab in Lead is located in the former Homestake Gold Mine. Of the 370 miles of tunnels, just 12 are maintained to house world-class laboratories where international dark matter and neutrino experiments are being conducted in search of answers to the origins of the universe.

Last week it was announced that South Dakota Mines has been awarded a $750,000 NASA grant to develop a power source for long-term space missions, with extremophiles isolated from SURF to be used as test subjects.

The Indo-U.S. Science and Technology Forum and Government of India has awarded fellowships for two chemical engineers to spend the next year in the Black Hills conducting research at South Dakota Mines laboratories with Rajesh Sani, Ph.D., of the Department of Chemical & Biological Engineering. Their projects focus on “Extremophilic Bioprocessing of Lignocellulose-based Renewables for Biofuels and Bioproducts.”

“Last year I worked with and supported these engineers on their applications. We came up with good proposals which have synergy with my group's ongoing extremophilic research,” Sani said. Over the past decade Sani's group has been looking for thermophiles that can naturally degrade and ferment cellulose and xylan, a polysaccharide found in plant cell walls.

“We believes that these microbes can circumvent the multiple steps of fuel production, including pre-treatment, saccharification, fermentation and separation of the product,” he said. In a recent study Sani's group showed that at 70 degrees Celsius thermostable hydrolytic enzymes from a Geobacillus sp. thermophile were able to convert untreated prairie cord grass and corn stover to fermentable sugars much more effectively than commercial enzymes.

The thermophiles produce biohydrogen or bioethanol in a single step using inexpensive regional untreated biomass such as prairie cordgrass and corn stover, as well as mixed food and human wastes, Sani said.

Visiting researchers Sachin Kumar, Ph.D., deputy director/scientist at the Sardar Swaran Singh National Institute of Bio-Energy, and R. Navanietha Krishnaraj, Ph.D., technical officer at the National Institute of Technology, Durgapur, India, will arrive in September and stay through August of 2017.

The Forum and Government of India award will cover airfare, health insurance and $3,000 in monthly expenses each.
Students Win Butterfield Cup for App That Helps Detect Counterfeit Drugs

A five-student team from the South Dakota School of Mines & Technology has won the 2016 Butterfield Cup, awarded by local entrepreneurs to the best mobile app business plan, product and investor pitch. The cup comes with a trophy, a prized seat at a start-up boot camp and dinner with university President Heather Wilson and local venture capitalists.

This year, the client for the competition was the Center for Security Printing & Anti-Counterfeiting Technology, a research center established by the South Dakota School of Mines & Technology, South Dakota State University and the University of South Dakota. The winning team designed an app that finds variations in isotope abundances to detect counterfeit drugs.

Team members included computer science junior Benjamin Kaiser, from Cheyenne, Wyo., math and computer science senior Bryon Glass, from Washington, D.C., computer science junior Akshay Singh, from India, math and computer science junior Cassidy Vollmer, from Hot Springs, and computer science junior Taylor Doell, from Elsie, Neb.

The culmination of a semester's worth of work, the second-annual competition pitted seven Mines teams led by student CEOs against each other to develop the best product.

Last year’s winners were finalists in the Governor’s Giant Vision Student Business Competition for Bowtaps, a mobile app with features to track friends and fellow users at events and provide businesses a platform to showcase their venue.

Kodzomoyo Selected Best Female Undergraduate Researcher at SDAS Symposium

Selected from among more than 100 presenters, Ellen Kodzomoyo, a chemical engineering senior, was selected as the American Association for the Advancement of Science (AAAS) best female undergraduate for her research on “Sub-Critical Hydrothermal Liquefaction of Lignocellulosic Biomass for Lactic Acid Production” at the South Dakota Academy of Science 2016 symposium. She was also awarded an AAAS annual subscription.

Kodzomoyo, from Harare, Zimbabwe, is doing undergraduate research under the supervision of Wei Nan, Ph.D., Anu Shende, Ph.D., and Rajesh Shende, Ph.D.

The AAAS is an international nonprofit dedicated to advancing science, engineering and innovation throughout the world for the benefit of all people.

About Legacy News

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