

South Dakota School of Mines & Technology

Legacy News

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New REU site aids nation's wireless grid, energy independence and defense

The School of Mines has been awarded nearly a quarter of a million dollars for the new Research Experience for Undergraduates (REU) site, "Bringing Us Together, Improving Communications and Lives." The site joins two others at Mines – one of only two universities in the state to have three active REU sites.

A 10-week summer program in electrical and computer engineering, the new REU site will expose undergraduates to hands-on research in communications related to global society and the country's economy and defense. Students will investigate topics including unmanned vehicles, such as drones, used to clear buildings and in search and rescue operations; antennas for use in ground-penetrating radars and land mine detection; and analysis of bio-medical imagery, which allows for the detection of tumors. They will also explore renewable energy resources and their integration into the smart grid and wireless communications and networking, aimed at optimizing a frequency spectrum overburdened with wireless devices like cell phones and GPS.

Aimed at expanding the size and diversity of the nation's science and engineering pool, the site will focus on underrepresented students, with the goal of having women and veterans comprise at least half of the participants, both from Mines and universities around the country.

"In addition to doing research, I believe an integral part of being successful beyond the undergraduate level is being able to communicate your results. We plan a heavy emphasis on technical communications. ... Regardless of what career path the students pursue, this will be valuable in their futures. I hope the students gain a love of learning (research), valuable communications skills and go on to pursue graduate degrees in science and engineering fields," said Thomas Montoya, Ph.D., director of the REU site and associate professor in the Department of Electrical & Computer Engineering.

Co-funded by the National Science Foundation and the Experimental Program to Stimulate Competitive Research, the new

CONTINUES ON PAGE 4 _____

Mines research refurbishing bombers at Ellsworth Air Force Base



The South Dakota School of Mines & Technology and Ellsworth Air Force Base have signed an agreement formalizing a relationship for collaborative projects such as the application of a revolutionary research technology to refurbish aging bombers. The university's partnership with Ellsworth has already helped return four B-1s to service and could save the military millions of dollars.

School of Mines faculty researchers in connection with the Army Research Lab have developed a patent-pending process using cold-spray technology to deposit aluminum powder in worn and damaged areas of aircraft panels, machining them back to their original dimensions and returning the bombers to full service. Prior to this research, panels were nearly impossible to replace without extreme cost and time, as the original equipment manufacturer no longer produces the nearly 30-year-old aircraft components.

"The research Mines has done already on cold spray technology has saved the Air Force over half a million dollars. We want to continue to work together to advance technologies that lower maintenance costs and keep aircraft available to fly," said School of Mines President Heather Wilson.

Cold-spray technology refurbishments have the potential to save the military hundreds of millions of dollars over the long term. With proper approvals, another \$2.5 million could be saved this year alone on the B-1s at Ellsworth.

Wilson, a 1982 U.S. Air Force Academy graduate and a former Air Force officer, signed the memorandum of understanding with Col. Kevin Kennedy, commander of the 28th Bomb Wing at Ellsworth.

"This memorandum provides a way for Ellsworth AFB and the South Dakota School of Mines & Technology to work together in finding innovative, aviation specific applications for emerging technologies. Innovation is in every airman's DNA. The students and faculty at Mines are known as some of the more outside-the-box thinkers in our community. This was a natural partnership that will benefit our wing and Mines' students," Kennedy said.

An emerging new technology, cold spray is capable of depositing a wide variety of metal powders to create high-performance coatings on diverse materials without overheating them. Research being conducted at the School of Mines is applicable throughout the Department of Defense for similar repairs on other weapon systems and also has broad commercial applications.

Christian Widener, Ph.D., an associate professor who is also director of both the university's Repair, Refurbish and Return to Service Center and the Arbogast Materials Processing and Joining Laboratory, leads the development of the cold-spray technology at Mines. He noted the agreement provides an important framework to allow the university to support the Air Force base by transitioning its research from the laboratory and applying it to real-world issues.

The collaborative approach also provides beneficial hands-on problem-solving opportunities for Mines students. Brian James, a School of Mines doctoral student who has worked with Widener on the research, is an Air Force Engineering and Technical Services representative at Ellsworth.

2014 Research Symposium highlights value of student projects

Mines students will showcase their research endeavors at the annual Research Symposium on Tuesday, April 8, in the Surbeck Center.

The public is invited. Among the 57 student presentations are topics ranging from "Counterfeit Prevention of Microelectronics through Covert Anti-Tamper Microcapsules," "Seismic Wave Frequency Filtering During Computer Modeling of Geophysical Explosive Charges," "Touch Screen Verification with Biological Features" and "Atom Efficient and Sustainable Hydrogen Production by Photoreforming of Acid Hydrolyzed Pinewood Extract."

Following the presentations will be an award ceremony in the Surbeck Center Ballroom for participants, judges, session chairs and department heads from 6-7:30 p.m. Mines President Heather Wilson, guest speaker, will present "Stewarding the National Security Research & Development Enterprise: Lessons Learned Along the Way."

"Research is an integral component of education at the School of Mines, and this student symposium provides a special way for students to describe to others what they have discovered through their research. Presenting research results in a community setting is an essential component of the research experience and is the capstone of a research project," said Ron White, Ph.D., vice president for research affairs.

Annual expo unites cultures

International students from the South Dakota School of Mines & Technology and a variety of community groups celebrated their cultural diversity with food, entertainment and displays during the annual expo on March 27 and 29. Approximately 20 countries were represented.

School children from throughout the Black Hills attended Thursday's events, which included cultural activities, storytelling and traditional crafts.

Open to the campus and community, Saturday's entertainment featured a variety of traditional music, dancing and fashion shows from a wide range of cultures along with a breadth of cuisine.

Mines currently enrolls 135 international students from more than 35 countries. International students have been sharing their cultures with the community through this annual event for more than 40 years.

In addition to the Ivanhoe International Center and the university's Student Association, other sponsors of the annual festival were International Students, Inc., Black Hills Power and Pepsi.

See photos at www.flickr.com/photos/sdsmt



Public invited to oil & gas conference

The 9th annual New Horizons Oil & Gas Conference will be hosted by the South Dakota School of Mines & Technology April 23-26, attracting geoscientists and related professionals from the Rocky Mountain region.

Many events are also open to the general public, including a guided day-long field trip to the geologic wonder of the "Paleozoic and Mesozoic Reservoir Rocks of the Southern Black Hills Uplift" and a number of educational sessions. The field trip will be led by Mines faculty researchers and experts from the South Dakota Geologic Survey. The cost will be \$100.

Topics of the Thursday, April 24, public sessions, which will be free of charge to the public, include:

- "The Petroleum Industry and Regional Economic Development," 1-3 p.m.
- "Hydraulic Fracking and Other Mysteries of the Oil and Gas Business," 3:30-5 p.m.
- "Environmental Impacts of Petroleum Exploration and Production," 7-8:30 p.m.

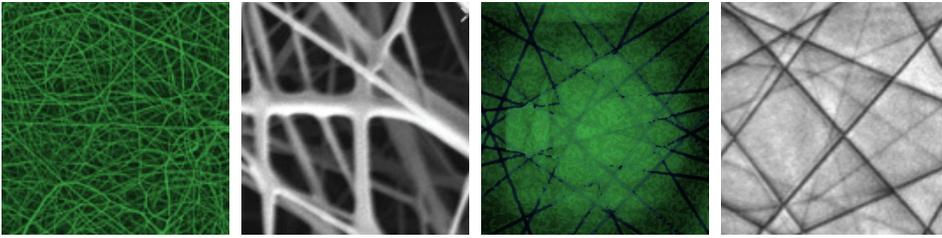
The conference focuses on oil and gas activities in the northern Great Plains and Rocky Mountains, especially as they affect the Williston, Powder River and Denver-Julesburg producing basins, the scenes of major petroleum exploration efforts resulting from new technologies. Rapid City is centrally located among these areas.

"The Black Hills are an ideal location for this petroleum conference. Rock layers which produce oil and in the surrounding areas are at the surface here. Geologists can walk up to an outcrop and see the material which they have only viewed previously as small chips from a well bore, or as lines on a graph which measures electrical and other responses of the rock buried far beneath the surface," said Alvis Lisenbee, professor emeritus with the Department of Geology & Geological Engineering and one of the conference organizers, adding the Black Hills' proximity to the three major basins is also a plus.

All conference events will occur at the former National American University location near downtown at Fourth and Kansas City streets.

For additional details and the full schedules, visit <http://www.sdsmt.edu/conferences/NHOG/>

Nano Expo highlights small ideas with big impact



Slated for Saturday, April 12, the South Dakota School of Mines & Technology Nano Expo 2014 showcases small-scale technology making a big impact, as students present their research from 1-3 p.m. in the Surbeck Center Bump Lounge on campus.

Designed for current and potential students, parents and community members who may have an interest in Mines' Nanoscience and Nanoengineering Ph.D. program, or for those who simply want to know more about nanotechnology in South Dakota, the annual event is open to the public, and admission is free.

Students will present posters highlighting their dissertation research and will also be available to explain their work to visitors. Broad in scope, research ranges from solar cells and micro-antennas to sustainable habitats in space aided by the development of structural, thermal insulation composites.

The nano Ph.D. program is an interdisciplinary doctoral program focusing on the science and engineering of nanomaterials. The goal is to manipulate matter at the atomic and nano length scales where new materials and phenomena have been discovered.

The program offers a research intensive degree, with faculty and students from chemistry, physics, chemical, electrical, materials and metallurgical and mechanical engineering participating.

Active research areas pursued by School of Mines students and faculty include:

- Producing nanocomposite materials that incorporate carbon nanotubes and nano-fibers, which are stronger and lighter, with improved properties over conventional materials.
- Developing photo-activated nano-inks used in direct write applications such as flexible electronic circuits, lower-cost solar cells and secure printing.
- Synthesizing improved nano-structured solar cells including "quantum dots," sometimes referred to as "artificial atoms."

CONTINUE FROM PAGE 2

REU site is the recipient of \$274,400.00. It joins two other sites at the School of Mines: "Back to the Future" focused on research in metallurgical engineering and "Security Printing and Anti-Counterfeiting Technology" (SPACT).

"One of the hallmarks of a Mines education is our hands-on, engaged learning approach. We are very pleased to be able to offer a third funded summer research experience for undergraduates," Mines President Heather Wilson said.

"This National Science Foundation award underscores the great work done by faculty and students at the South Dakota School of Mines & Technology. The REU site is a tremendous tool that will help students as they pursue their degrees in electrical and computer engineering. I am especially pleased the REU site has an emphasis on involving women and veterans in science education," U.S. Senator Tim Johnson added.

The university also serves as the lead institution for the newly created SPACT center, where researchers address the nation's most pervasive and destructive security and counterfeiting problems ranging from passports to pharmaceuticals.

REU Directors Grant Crawford, Ph.D., assistant professor, and Michael West, Ph.D., head and associate professor, Department of Materials & Metallurgical Engineering, are also leading an effort to implement a summer undergraduate symposium in Pierre that will bring together sites from across the state.

Students head to D.C., exhibit 3D evolution at national festival

Students from the School of Mines are heading to Washington, D.C., to showcase the evolution of 3D representation at the Superbowl of STEM: the 2014 USA Science & Engineering Festival. Designed to inspire the next generation of innovators, the April 25-26 festival draws more than 250,000 kids and adults to 3,000 free, hands-on activities and 100 live stage performances.

Entitled "3D Printing in Space," Mines' exhibit will demonstrate how a 3D printer deposits material to make an object and offer attendees the chance to print an object by hand. "One thing 3D printing can be used for is to make parts. If a part on a spacecraft was to fail, and you can't take every single spare part along with you, with the digital plans, one could print one," explains Linda DeVaux, Ph.D., associate professor, Department of Chemistry & Applied Biological Sciences.

Neither DeVaux nor the three of the students attending – senior industrial engineering and engineering management majors Derek Bankston, from Aberdeen, Andrea-Marie Babbs, from Belle Fourche, and Taylor Mammenga, from Humboldt – had previous experience in 3D printing, learning a wealth of information themselves about the emerging technology as they prepared for the event, sponsored by Stratasy and EMIT Technologies.

DeVaux, who participated in the festival at another university, had focused previous activities on radiation and microbes, drawing from her own research. This year, she, along with Bankston, Babbs, and Mammenga chose 3D representation for its tie to NASA-related research at Mines, which ranges from materials for future space habitats to internships spent refurbishing Apollo spacecraft.

Bankston hopes the young attendees will not only take away "a memorable, hands-on experience with additive manufacturing," but something more intangible – the inspiration to pursue their dreams in science and engineering.

"All of the senior design members have a unique story of why we chose to study engineering. It may have been a person or a neat object. I hope that by being at the festival, we could be their reason," Babbs adds. Other students attending are Zachary Scheuffele, a mechanical engineering senior from Wagner, and Jessica Evans, a biomedical engineering graduate student from Pocatello, Idaho.

Sponsored by Lockheed Martin, the festival will feature science celebrities and experts. Celebrities include *Dirty Job's* Mike Rowe, Bill Nye the Science Guy and the cast from *Big Bang Theory*, *House* and *Breaking Bad*.

Engineering students geared up for service abroad during spring break



Among Mines students working in Colombia: Michael Dollarhide (CEE14), Kati Johnson (CBE14), Tony Kulesa (MSCEE'14), Cody Schellinger (CEE15), Elizabeth Woody (CSC'15), Logon Vogt (CEE15), Erik Walega (MSGeoE15), ESA Advisor Thomas Fontaine, Ph.D.

Two groups of South Dakota School of Mines & Technology students headed abroad during spring break vacation to lend their engineering expertise to projects that will improve the lives of others.

One group from the Mines chapter of Engineers and Scientists Abroad (ESA) traveled to Bogotá, Colombia, to begin the design and installation of a rainwater harvesting system, as well as remediating a landslide-prone slope. The group collaborated with like-minded peers from Pontificia Universidad Javeriana and Irma and Richard Frank, whose past donations and future commitments to fund international experiences have played a pivotal role in ESA's good deeds. Richard Frank is a 1963 mechanical engineering graduate from the School of Mines.

Because of the high level of annual precipitation in the Bogotá area, roughly 30-40 inches per year, rainwater harvesting is of particular interest. ESA's plan was to create a simple, repeatable design based on materials common to the area and collect precipitation data, which could be implemented on a large scale for many local residents.

The Colombia team was comprised of Tony Kulesa, a graduate student from Rapid City; Cody Schellinger, a senior from Sheridan, Wyo.; Logon Vogt, a senior from Chadron, Neb.; and Michael Dollarhide, a senior from Pipestone, Minn., all civil and environmental engineering (CEE) students; Erik Walega, a geological engineering graduate student from Lafayette, Colo.; Elizabeth Woody, a junior mathematics

and computer science major from Zaporozhye, Ukraine; and Kati Johnson, a senior chemical engineering major from Buffalo.

A second School of Mines ESA team traveled to Peru to help improve conditions at the Wesfalia Orphanage in the hilly area of Cieneguilla, about 90 minutes from downtown Lima, Peru.

ESA members designed and constructed new infrastructure to provide needed improvements to supply the orphanage with a permanent clean water source, new plumbing and solar energy to replace gas, as well as allowing the addition of a fruit orchard. Mines students made contact with Westfalia through family and mutual friends and plan to return for consecutive years to complete infrastructure improvements.

Westfalia is a non-government funded orphanage dedicated to helping about 100 children by providing housing, education and psychological assistance to children with serious emotional development problems.

The Peru team was comprised of Carl Holloman, a sophomore from Rapid City; Kevin Barry, a senior from Rapid City; Kylie Berger, a senior from Sioux Falls, and Tony Kulesa, a graduate student from Rapid City, all CEE majors. Two students from a similar organization in Colombia joined them.

See the videos from Colombia and Peru online.

STEMinists unite

Despite making up roughly half of the college-educated U.S. workforce, women are still vastly underrepresented in science, technology, engineering and mathematics (STEM) careers. For the South Dakota School of Mines & Technology Youth Programs, change begins in the classroom.

On Thursday, April 3, more than 200 area middle school girls will converge on campus for the ninth annual Girls' Day, participating in breakout sessions featuring blacksmithing, making an edible aquifer and saving Romeo and Juliet through mathematics.

They will also hear from Molly Gribb, Ph.D., head and professor in the Department of Civil & Environmental Engineering, and Professor Carter Kerk, Ph.D., and faculty members of the Department of Industrial Engineering. Kerk will lie between two beds of nails as a concrete block is crushed on his chest to illustrate some of the scientific principles underlying safety engineering.

Panel explores the aftermath of Atlas

After the devastation of last October's winter storm Atlas, students in the Weather Club at the South Dakota School of Mines & Technology wanted to explore the science behind the storm. Partnering with the Black Hills chapter of the American Meteorological Society, they put together a panel discussion with representatives from the National Weather Service, S.D. stockgrowers, local media, State Veterinarian's Office, Pennington County Emergency Management and Black Hills Power. From 6-8 p.m. Tuesday, April 8, in the Classroom Building, room 204 east and west, the panel will discuss the meteorology of the event and then participate in a Q&A focused on the October blizzard's impact and community's response. The event is open to the public and free of charge.

Students will also hold a silent auction featuring items and gift certificates from local businesses to benefit the Rancher Relief Fund. "Their goal is to make this not just an informative evening, but to also help out those that are still feeling the impacts of the blizzard several months later," said Adam French, Ph.D., assistant professor of the Department of Environmental & Atmospheric Sciences.

Professor emerita, author Elizabeth Cook-Lynn to give lecture at Mines



The Office of Multicultural Affairs at the South Dakota School of Mines & Technology will present a 90-minute guest lecture by Elizabeth Cook-Lynn from 6-8 p.m. Tuesday, April 15, in the Electrical Engineering & Physics Building, room 252, on campus. The lecture is open to the public, and media is invited to attend.

Cook-Lynn will cover subjects such as tribal government and the American Indian history of dissent – AIM, the BIA and Post-War activism – in her lecture entitled, “Indian Policy and History,” followed by a 30-minute discussion period.

Cook-Lynn, a member of the Crow Creek Sioux tribe, is professor emerita of Native American studies at Eastern Washington University, a writer and a poet. Her books include *Anti-Indianism in Modern America: A Voice from Tatekeya’s Earth*, *The Politics of Hallowed Ground: Wounded Knee and the Struggle for Indian Sovereignty* (with Mario Gonzalez), *Aurelia: A Crow Creek Trilogy* and “Why I Can’t Read Wallace Stegner” and *Other Essays: A Tribal Voice*, winner of the Gustavus Myers Center Award for the Study of Human Rights of North America.

The lecture will take place in conjunction with the “History of the American West” course, taught by Frank Van Nuys, Ph.D., associate professor, Department of Social Sciences.

Dinosaur Invasion: April 12 Extravaganza

Uncover great animals of the past at the sixth annual Dinosaur Extravaganza at the Museum of Geology from 1-4 p.m. Saturday, April 12.

The popular event sponsored by the Museum of Geology and the university’s Paleontology Club features hands-on activities about dinosaurs and their environment.

Walk through time and unravel some of the mysteries of South Dakota’s past with the “Dinosaurs: When and Where” exhibit; absorb the many facts and fictions about dinosaurs and how our understanding of them has changed over the years with the “History of Paleontology” booth; and learn basic field techniques in the dig box as you slowly brush away sand and dirt.

Other features include painting fossil casts, creating your own dinosaur scene and searching for dinosaur “ducks” for prizes.

Dinosaur Extravaganza is free and open to families with children up to age 12. For additional information about the museum, log on to www.sdsmt.edu/Museum-of-Geology/Visit-the-Museum/ or call (605) 394-2467.

Clean Snowmobile team takes second in SAE competition



Hardrocker SAE Clean Snowmobile team members, from left: Riley Hosman, sophomore, electrical engineering, Brandon; Bennett Prosser, junior, mechanical engineering, Sturgis; Mathew Daniels, sophomore, electrical engineering, Brooklyn Park, Minn.; Spenser Foster, junior, mechanical engineering, Flandreau; Doug Kadrmas, junior, electrical engineering, Dickinson, N.D.; Kyle Roe, junior, mechanical engineering, Hayti.

The South Dakota School of Mines & Technology Clean Snowmobile team took second in the zero emissions division of the 2014 Society of Automotive Engineers (SAE) Clean Snowmobile Challenge, triumphing in one of Michigan’s snowiest winters in years – ideal sub-freezing conditions for the SAE design competition.

In the Clean Snowmobile Challenge, engineering students compete in a variety of categories. The internal combustion category aims to reduce emissions and noise and increase fuel efficiency while preserving the riding excitement demanded by snowmobile enthusiasts. The zero emissions category, sponsored by the National Science Foundation, relies on electric snowmobiles to conduct atmospheric research in pristine arctic locations.

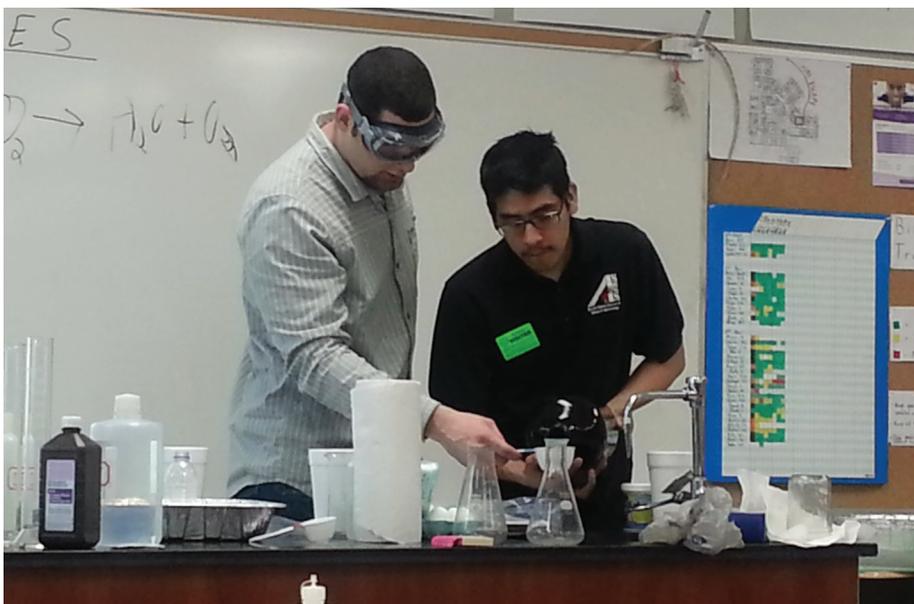
“Advances like these are critical to the future of snowmobiling,” said Art Jeffers, acting forest supervisor of the Huron-Manistee National Forest, who represented the U.S. Forest Service at the challenge. “The snowmobiling industry and the clubs have made great strides, and with their sponsorship, the Challenge has been a great way to move the technology forward.”

Next year, the challenge will dedicate a separate category to diesel-powered sleds, as demand mounts for diesel technology education from companies such as John Deere and Caterpillar. Sleds in the challenge will continue to use a biofuel mix based on gasoline and isobutanol, requiring future entries adapt to a mystery blend fuel recipe that contains an unknown percentage of isobutanol.

Team members are Riley Hosman, an electrical engineering sophomore from Brandon; Bennett Prosser, a mechanical engineering junior from Sturgis; Mathew Daniels, an electrical engineering sophomore from Brooklyn Park, Minn.; Spenser Foster, a mechanical engineering junior from Flandreau; Doug Kadrmas, an electrical engineering junior from Dickinson, N.D.; and Kyle Roe, a mechanical engineering junior from Hayti.

The Clean Snowmobile team falls under the purview of the Center of Excellence for Advanced Manufacturing and Production (CAMP). The center is designed to teach students engineering, science and design skills, as well as the ability to work in teams. Team members design, build, market and raise the money for their projects.

Students empower Native American youth to pursue higher education



Senior chemistry major Jacob Phipps and junior physics major Domingo Tamayo conduct chemistry experiments at schools on the Pine Ridge and Rosebud Indian reservations in an outreach effort aimed at empowering Native American youth to pursue higher education.

In the starkly beautiful grasslands of the Pine Ridge and Rosebud Indian reservations, more than 10,000 children face grim statistical categories: high school dropout, unemployed, at risk. And of the youth who graduate high school, just over one-tenth earn bachelor's degrees. This spring break, the American Indian Science & Engineering Society (AISES) chapter at the South Dakota School of Mines & Technology visited four reservation schools in an outreach effort aimed at empowering youth to pursue higher education – and radically change the trajectory of a generation.

Visiting St. Francis High School, Todd County High School, Red Cloud High School and Sinte Gleska University, Jacob Phipps, a senior chemistry major of the Muscogee Nation (Creek), from Mesa, Ariz.; Domingo Tamayo, a Sicangu Lakota junior and physics major from the Rosebud Sioux tribe; and Kimberlynn Cameron, a geological engineering senior of the Standing Rock Lakota tribe, conducted hands-on experiments with local students and presented on their internships and research.

Phipps focused on chemistry and its applications.

"The chemistry experiments I did with them included elephant's toothpaste, iodine clock reaction and a hydrophilic polymer that absorbed 300 times its weight. ... Some of the students realized that its (the polymer's) main use was in disposable diapers. This led

to me talking about applying what they learn in the classroom to real life. I left each class with this: 'Take something you learn this week in class and apply it at home,'" said Phipps.

Hailing from a town of more than 400,000 in the desert southwest, visiting the rural reservation was an eye-opener for Phipps – but not one without promise. "I gained knowledge of their current situations ... and some of the challenges they face. I hope the students took out of it that it is possible to leave home, the reservation, and make it on our own. It is possible to get a higher education, and there are so many opportunities for us, the Native American family. ... I hope they will attempt to make an effort to look for scholarships and apply for college and pursue what they love."

And he hopes to be back next year, doing his part to "change the numbers of Native Americans as a whole in higher education."

AISES is a national organization whose goal is to substantially increase the representation of American Indian & Alaska Natives in science, technology, engineering and math. The Mines chapter strives to uphold this mission through professional development, educational outreach and cultural identification.

8th annual 5K Dublin Dash



Sporting St. Patty's Day fare and the luck of the Irish, runners went for the (pot of) gold at the 8th annual South Dakota School of Mines American Institute of Chemical Engineers (AIChE) Dublin Dash.

Beginning at 9 a.m. on the School of Mines campus quad, runners completed a 5K course ending with a post-race ceremony at Dublin Square in downtown Rapid City. Prizes were awarded to individuals and groups with the most original costumes.

The main fundraiser for the School of Mines AIChE, the Dublin Dash designated proceeds to Mines students attending the national and regional conferences for the American Institute of Chemical Engineers, community outreach efforts and student scholarships.

About Legacy News

Legacy News is produced by the Office of University Relations the first Wednesday of each month. The newsletter is a compilation of news releases, photos and Web articles.

To submit news or story ideas or to subscribe to the email distribution list, please contact Fran LeFort, communications manager, at 605.394.6082 or at fran.lefort@sdsmt.edu. For more School of Mines news, visit news.sdsmt.edu

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