Two new Governor Research Centers are headed to the South Dakota School of Mines & Technology, answering the call for industry demand and bringing the potential for significant economic development within the state.

Each awarded $2 million over the next five years, the centers will focus on advanced manufacturing techniques with ultimate application uses in the automotive, aerospace, energy, construction and other industries.

The new Governor Research Centers are Advanced Manufacturing Process Technology Transition & Training (AMPTEC), under the direction of Christian Widener, Ph.D., and Composite & Nanocomposite Advanced Manufacturing (CNAM), under the direction of David Salem, Ph.D.

The centers were chosen based on their ability to establish and build upon industry relationships and have a strong potential for commercialization, according to Paul Turman, vice president for research and economic development at the South Dakota Board of Regents, which announced the new research centers on July 1.

“These two new centers will continue to expand Mines’ research in materials and manufacturing,” Heather Wilson, D.Phil, president of the South Dakota School of Mines & Technology, said. “Dr. Widener and Dr. Salem who are leading these efforts are doing a great job and we are proud to have them at Mines.”

Widener has brought Mines to the cutting-edge of cold-spray technology, involving accelerating particles at super-sonic speed, which through his applications development efforts will save the U.S. military millions of dollars in refurbishments to the B-1 bomber. He is excited new experiments being conducted nearly a mile below the Earth’s surface at the Sanford Underground Research Facility could potentially uncover secrets of the universe, and School of Mines graduate student researchers will be there for the next great discovery.

Armed with a new physics doctorate, existing research excellence and its geographic proximity to the deep underground laboratory where the search for dark matter is already under way, the South Dakota School of Mines & Technology will strengthen its partnership with Sanford.

Wilson and a School of Mines team toured the Sanford Lab in her second week on the job. It was Wilson’s first look at the underground laboratory where scientists are conducting a search for the elusive subatomic particle. School of Mines physicists have played a significant role in the dark matter research.

Wilson began her role as university president on Monday, June 17.

“There’s a very strong synergy, and we hope to make it even stronger,” Wilson said of the partnership with the facility. “Sanford and the School of Mines will be doing world-class particle physics research.”

“If these experiments over the next decade are successful, the next great advances in understanding matter will happen here in South Dakota,” she said.

Wilson said opportunities at Sanford for graduate student researchers can only be found in a few places in the world.

“The School of Mines is a world-class technological university. Our partnership with Sanford allows us to engage in physics research that few other schools can match. Our expertise in mining and materials also makes our partnership with Sanford a very good fit,” Wilson said.

“We have physicists and chemists and materials folks and geologists working at Sanford every day. They’re teaching the next generation of graduate students, in addition to conducting breakthrough research. … It’s a very close working relationship and it pays big benefits in terms of teaching and advancing knowledge.”

Sanford is owned and operated by the South
Mines physicist to play integral role in new collaborative research center

South Dakota School of Mines & Technology imaging experts will play an integral role in a new collaborative research center that will lead to new biotechnologies to heal injuries and maintain human health.

The South Dakota Board of Regents and the governor’s office announced the creation of the new South Dakota Research & Innovation Center to link university-based research and National Science Foundation priorities. The new Governor Research Center will be a collaboration between researchers from SDSU, SDSM&T and the University of South Dakota, along with private-sector involvement from Sanford Health and Avera Health.

Steve Smith, Ph.D., director of the School of Mines nanoscience and nanoeengineering program, will lead the SDSM&T contingent, which will be based on bio-nanoscience with a focus on imaging at the nanoscale level. Smith is a physicist with expertise in optical imaging, specifically molecular-level or so-called super resolution microscopy applied to bio-physics and bio-materials.

The proposal will be under the project direction of Adam Hoppe at South Dakota State University. Researchers will use advanced imaging techniques and computational analysis to bridge current understanding of the consequences of plant and animal genetics, gleaned from bio-informatics, with knowledge of the influence of cellular architecture, discovered through imaging.

The work will advance the discovery of new plants that are more productive and disease resistant than current varieties, and lead to new biotechnologies to heal injuries and maintain human health.

“Molecular level knowledge of biological processes will continue to be one of the frontiers of science, extending long past our lifetimes,” said Smith, who runs a state-of-the-art imaging and spectroscopy laboratory at the campus ideal for the proposed work.

“The applications to human health, agriculture, etc. are too numerous to list. Imaging is the first step in understanding. With understanding comes new strategies for fighting disease, improving health and longevity and developing new bio-products.”

The state plans to commit $12 million in funds over the next six years to allow for translational research activity at the new center, generated from basic research conducted through NSF’s Experimental Program to Stimulate Competitive Research (EPSCoR).

SDSM&T’s portion is expected to be in the range of $4 million over the life of the project, according to Smith.

“This is a very important endeavor for SDSM&T, as we will be expanding our expertise in optics, imaging, nanoscience and bio-physics, and likely building good relationships with the biotech industry in South Dakota, something good for SDSM&T and South Dakota,” said Smith, who is currently funded through the NSF biomaterials program to study protein interactions by imaging single molecules.

Smith’s work with the new research center is a natural extension of that work.

Programming team at World Finals in Russia

The Russians call them White Nights, spectacular, luminous summer eves when St. Petersburg is bathed in a pearlescent glow. But in the days leading up to July 3, that luminescence will emanate from an entirely different source as more than 100 university programming teams gear up for the Olympics of computer science. In this Battle of the Brains, one team will emerge victorious to claim “The World's Smartest Trophy.”

And South Dakota School of Mines & Technology's student programming team is among the elite. Colton Manville of Rapid City, Trevor Mahoney of Scottsbluff, Neb., and Dean Laganiere of Racine, Minn., left Rapid City on June 20 to compete against 22 other United States teams and around 90 international teams, all vying for the 37th annual world title at St. Petersburg's Jubilee Arena.

Sponsored by IBM, this year’s contest exposes students to key emerging trends and capabilities, such as applying analytics technology to Big Data, a major economic growth engine and global career opportunity.

It is the fifth time a School of Mines team has qualified for the World Finals of the Association for Computing Machinery (ACM) International Collegiate Programming Contest (ICPC), “an accomplishment that, as far as we can tell, no other school of our size, and few other schools of any size, can claim,” says Toni Logar, Ph.D., who has coached the Mines team for 25 years. Other coaches are Roger Schrader and Larry Pyeatt, Ph.D. Ed Corwin, Ph.D., also of the School of Mines, served as Regional Chief Judge. ICPC organizers honored Corwin and Logar for bringing five teams to the contest throughout their coaching careers.

In November, students competed in the ACM regional qualifier against 239 teams representing eight states and two Canadian provinces. SDSM&T’s World Finals qualifying team was among five three-person Mines teams. All five teams from the university placed within the top third of the regional contest.

The contest fosters creativity, teamwork and innovation in building algorithms and programs to solve difficult problems, and it also tests the ability to perform under pressure.
Mines hosts 200 for international meet

The South Dakota School of Mines & Technology recently hosted 200 biologists, geologists, tribal representatives and other stewards of natural history preservation at an international conference.

The 28th annual meeting of the Society for the Preservation of Natural History Collections was held June 17-22 on campus.

Representatives from major museums and universities with biology, geology and paleontology collections from the United States, Canada, United Kingdom, Sweden, Germany, South Africa and other countries attended.

The School of Mines showcased its Paleontology Research Laboratory, home to more than 500,000 specimens. The state-of-the-art collections repository is part of the 128-year-old Museum of Geology.

The Integrated Digitized Biocollections (iDigBio) and Natural Science Collections Alliance (NCSA) symposium featured a series of internationally renowned professionals discussing the challenges and approaches to digitizing natural history collections and the dissemination of natural history data.

Whiting Petroleum Corp. gives for student support

Whiting Petroleum Corp. has given $40,000 to the Department of Geology & Geological Engineering for student support.

The partnership between the School of Mines and Whiting will enhance efforts to recruit top science and engineering students and build collaborative geoscience research, education and outreach efforts. Enrollment in the geology and geological engineering program has increased dramatically in the last five years with a 52 percent increase in undergraduate programs and a 69 percent increase in graduate programs.

Whiting’s gift will largely be used to enhance graduate student support, which will aid in recruiting students interested in energy sector careers. The gift also will support undergraduate and graduate student research and training opportunities, including travel for field trips, professional meetings and workshops.

The department is augmenting existing faculty research and teaching strengths through new faculty hires in strategic areas to elevate programs to national prominence. A new faculty member with expertise in basin analysis and tectonics will arrive in August.

GEARUP winds down

Approximately 300 Native American high school students who took part in the SD GEARUP Summer Honors Program on the Mines campus will graduate at 1:30 p.m. on Sunday, July 7, in the King Center. Native American students represented eight reservations and urban areas in South Dakota during the six-week residential honors program.

Students participated in challenging classes in science, technology, engineering and math. Along with classes, students toured area businesses and cultural centers and conducted a five-week water restoration and research project on the Pine Ridge Indian Reservation.
Summer youth camps blast off

The summer youth camp season is in full swing as the university hosts high school students from throughout the country for hands-on learning with experts in mining and explosives, paleontology, geology, electrical engineering, chemical and biological engineering, robotics and materials and metallurgy.

Students typically spend half their time on the School of Mines campus learning in classes but are just as often in the field for outings such as paleontology digs or observing the science behind explosives materials.
The South Dakota School of Mines & Technology has been ranked fifth in the nation for colleges and universities whose graduates make millions.

The new "Million Dollar ROI (Return on Investment)” rankings for 2013 was released July 27 by AffordableCollegesOnline.org (ACO) and includes a new list of public universities whose graduates out earn non-degree holders by at least $1 million during their careers. Institutions on the list make up the top 1 percent of U.S. colleges as measured by return on investment (ROI).

"This is yet another confirmation that the South Dakota School of Mines & Technology prepares leaders in science and engineering at a price families can afford," said Heather Wilson, D.Phil, new president of the university. “Our graduates go on to great careers leading and building some of the best companies in America.”

The most recent placement figures from the university’s Career & Professional Development Center show the average starting salary for 2011-2012 graduates was $62,696, with 98 percent landing jobs in the field for which they studied or going on to graduate school.

The field with the highest average starting salary for Mines grads was geological engineering with $72,333, with the next highest at $70,087 for metallurgical engineering.

According to AffordableCollegesOnline.org, the 30-year net return on investment for School of Mines graduates is $1.23 million.

SUNY Maritime College in New York was ranked first with a 30-year net ROI of $1.59 million; Colorado School of Mines was second at $1.57 million; the Georgia Institute of Technology was third at $1.39 million; and the Massachusetts Maritime Academy was fourth at $1.32 million.

Each school’s return on investment figure derives from a three-tiered calculation: estimated 30-year earnings of graduates minus both projected earnings without a degree and four years of tuition and fees.

“It’s important to recognize these are public universities that require a lower upfront tuition investment than their private counterparts, yet still provide students with the skills necessary for a higher paying career,” ACO founder Dan Schuessler said the organization’s news release. “ACO is dedicated to promoting affordability, and Ivy League schools are not the only ones with great ROI. These public colleges provide significant value to their students.”

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also director of another Governor Research Center, the Repair, Refurbish and Return to Service Center known as R3S.

Widener’s new center will focus on continuing to develop advanced manufacturing technologies, leveraging on the successes of the R3S, but with a focus on direct partnerships with industry to commercialize specific applications and processes.

Specifically, AMPTEC is developing an advanced six-axis manufacturing center that will be capable of both additive and subtractive processes and “will bring unique world-class capabilities in advanced manufacturing to the state,” Widener said.

“AMPTEC is positioning itself to be on the cutting edge of our national initiatives for developing advanced and additive manufacturing in the U.S.,” he said. Like the cold-spray technology, applications arising from the new center will include the aerospace component repair, next generation durable coatings for extreme service conditions and additive manufacturing.

In addition to the $2 million in funding from the state, the AMPTEC center has secured matching funds commitments from industry for a total of $4 million to jointly develop, license and commercialize technology from the School of Mines. A new manufacturing startup, VRC Metal Systems, was initiated to begin making cold spray and laser powder deposition equipment in Rapid City and is licensing a cold spray patent from the School of Mines.

VRC is projecting $1 million in sales after its first year, according to Widener, whose new center is also partnering with several small existing businesses in South Dakota, such as HFW Friction Stir Welding, Flexible Robotic Environment and Daktronics, and large corporations, such as MOOG, Nordson Xaloy, Kondex, Pure Fishing and New Tech Ceramics.

“The Composite & Nanocomposite Advanced Manufacturing Center (CNAM) is poised to meet the urgent commercial need for strong, lightweight, multifunctional composite and nanocomposite structures at high volume and low cost,” said Salem, adding recent advances make the commercialization feasible on an aggressive timetable.

“Numerous market sectors are now demanding materials with an improved strength-to-weight ratio, often in combination with other tailored functionalists, which is driving the need for fast and efficient composite manufacturing methods and low-cost raw materials,” Salem said.

In the automotive industry, this could include structural and engine components that will meet the 54.5 miles-to-the-gallon vehicle standards. In the energy industry, research could lead to a new generation of wind blades, tidal turbines, storage vessels and pipelines. In the construction industry, results could yield lightweight composite building materials, including building blocks, beams and panels.

The CNAM center is already working with nine leading companies, Continental Structural Plastics, Falcon Plastics, Innegra Technologies, Litzler Company, Owens Corning, PolyOne Corp, Raven Industries, SGL Group and Steelcase. Five of them are multibillion-dollar corporations, and two (Raven Industries and Falcon Plastics) are leading South Dakota corporations.

“These companies have the wherewithal to commercialize the technology rapidly and to bring manufacturing jobs to the state, which will become increasingly recognized as a hub for composites manufacturing innovation,” Salem said.

South Dakota State University is also partnering as subcontractors with the two new School of Mines centers.
New exhibit details nimravids history in South Dakota

Millions of years in the making, a new museum exhibit at the South Dakota School of Mines & Technology highlights the life of the nimravid.

“Nimravids Through Time” features specimens, also known as false saber-toothed cats, which roamed the lands now known as South Dakota 35 million to 28 million years ago.

Thirteen nimravid specimens are showcased, along with nine specimens of closely-related animals to show their relationships and defensive nature. One section of the new exhibit is dedicated solely to nimravid bite marks.

“The most famous painting on the museum wall is of the fighting cats, which is based on a specimen featured in the new exhibit that has a partially healed bite mark on its skull from another nimravid,” says Clint Boyd, Ph.D., postdoctoral fellow at Mines who, along with Mindy Householder, resident scientist and preparator at the Museum of Geology, prepared and designed the new exhibit. “Nimravids were hypercarnivores, meaning they need a diet extremely high in protein and likely would not process or digest plant matter very easily.”

Nimravids first evolved in the Eocene period, when the climate was warm and wet. The transition between the Eocene and Oligocene periods is marked by the climate becoming cooler and dryer. This resulted in an environmental change in South Dakota from more forested areas to the eventual expansion of grasslands and more open environments. “The nimravids appear to be better adapted to the forested environment, so as the climate and the environment changed they were eventually replaced by carnivores that were better adapted to that environment. Otherwise, they were a lot like modern cats, including the retractable claws,” Boyd said of the nimravid’s demise.

Most of the exhibit’s specimens were collected by either museum employees or School of Mines faculty between 1924 and 2001. The Museum of Geology’s summer hours are 9 a.m.-5 p.m. Monday through Friday, 9 a.m.-6 p.m. Saturday and noon-5 p.m. Sunday.

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Student awarded $10,000 national scholarship

Tony Kulesa, a master’s student in civil engineering at the South Dakota School of Mines & Technology, has been selected as the Scholar of the Year by the America Council of Engineering Companies (ACEC).

Kulesa’s entry marks the first time South Dakota has participated in the scholarship program. ACEC/SD State Director Todd Kenner, PE, president of RESPEC, and ACEC/SD Secretary-Treasurer Rod Senn, PE, office manager of KLJ, presented the $10,000 national scholarship to Kulesa. A formal presentation will follow this October at ACEC’s 2013 fall conference in Scottsdale, Ariz.

Applications are scored against five criteria, including academic excellence, extracurricular involvement, work experience, essay entries and letters of recommendation.

Kulesa is spending the summer immersed in on-site experiences at the Johnson Space Center in Houston and the Kennedy Space Center in Orlando, Fla. During his NASA Space Technology Research fellowship, he will test novel materials made at the School of Mines’ CAPE lab and collaborate with other NASA groups to undertake research endeavors in his areas of interest.

With roots dating back to 1909, today ACEC is a large federation of 51 state and regional councils representing the great breadth of America’s engineering industry, its member firms employing more than 500,000 engineers, architects, land surveyors, scientists and other specialists around the country. Responsible for more than $200 billion of private and public works annually, these firms engage in a wide range of engineering works that propel the nation’s economy and enhance and safeguard its quality of life.

Dakota Science and Technology Authority, with support from the Department of Energy and oversight by DOE’s Lawrence Berkeley National Laboratory.

Efforts at the laboratory have resulted in a $120 million economic impact in the state to date, including operational and infrastructure costs. Sanford is home to 14 active research groups, 13 of which include researchers from the School of Mines, according to Lab Director Mike Headley.

“It’s a very impressive facility. It’s very clear that the State of South Dakota is making a tremendous investment in the future of science and in the preparation of leaders in science and engineering,” Wilson said.
Thesis leads to hope for Pine Ridge youth

On a rolling prairie nestled deep in America’s heartland, cresting upward to wind-blown dunes, among scattered pines and the clay-rich lunar landscape of the Badlands, winds the White River. Cutting through the land west to east, it derives its name from a whitish-gray mix of eroded sand, clay and volcanic ash.

Of the more than 3,000 counties in the United States, this river runs through one of the poorest: Shannon County, home to the Pine Ridge Indian Reservation. Situated on the southwest corner of South Dakota near the Nebraska border, Pine Ridge is the second-largest reservation in the United States, larger than Delaware and Rhode Island combined. It bears an unemployment rate of 70 percent, a life expectancy in the mere 40s and a high school graduation rate of less than 10 percent.

Yet it is not a place without hope – or promise. Nick Marnach, a May graduate from the School of Mines, would know. He spent almost a year there working on his master’s thesis in civil and environmental engineering. “Great possibilities exist. ... There’s beauty there, people who are striving and intelligent and working for their people. They’re proud.”

In June of last year, Marnach, now employed as an engineer at RESPEC, embarked on an environmental education project, an experience that would change his life.

His goal: protecting water resources on Pine Ridge through stewardship and public education on environmental impacts and water resource management, and encouraging students to pursue studies in related fields.

In an area where 87 percent of land use is dedicated to agriculture and resources are disproportionate to the scale, the need for natural resource management is critical.

So Marnach got to work. Through a U.S. Environmental Protection Agency education grant, Marnach and Mines professors Jennifer Benning, Ph.D., Scott Kenner, Ph.D., and Foster Sawyer, Ph.D., along with students, partnered with the Oglala Sioux Tribe Environmental Protection Program in an effort focused on the protection of water resources.

Marnach’s first step was to bring together all the organizations involved, including the Oglala Lakota College; Pre-Engineering Educational Collaborative students; and the Gaining Early Awareness and Readiness for Undergraduates Program (GEARUP), among a host of other government and tribal entities.

The first challenge was deceptively simple: collect data. Water quality is heavily affected by an economy based almost exclusively on agricultural practices. Without consistent measuring, it’s impossible to determine the types and levels of pollutants in the water.

Through continuous flow monitoring equipment, Marnach could measure the river’s flow from its highest point to its lowest during an entire season. Consequently, he could now consistently measure and compare surface water quality through baseline water sampling, rainfall runoff and excess from creek rises.

Marnach also needed to instill stewardship, educate, foster collaboration, address disparate needs and formulate a plan that would sustain the project long after he earned his degree.

He needed someone to help deliver this message, someone with cultural insight who could generate buy-in among the greater group, who would carry the project into the future. Someone like the youth, who make up 50 percent of the population.

The students Marnach refers to are the 250 GEARUP participants that converge on the Mines campus each summer. These students undertook field modules. Sophomores did biological assessments; juniors focused on water chemistry and seniors concentrated on physics, such as stream flow measurement. He also recruited students at Oglala Lakota College to count and analyze water bugs.

Marnach understands “there will be critics who say the data is unreliable as it was collected by non-experts” but he notes that they “have tools to make data reliable” and underscores the importance of an effort far larger than a data point.

“I have the potential to reach out and establish the roots for the creation of possible tribal watershed management personnel in the future, to foster job growth in a majority youth population and to allow for a greater share in the management of resources,” a collaboration he hopes to continue, though at this point, means and funding remain uncertain.
New minors approved at the June meeting are:

• A 19-credit hour minor in applied biological science: Coursework will focus on biological principles applicable to many careers in science and engineering, such as bioprocessing, bioenergy, biomaterials and biomedicine. South Dakota industries involved in biofuels and bioprocessing work at the intersection of engineering and biology, and graduates with a strong knowledge base in both areas often have a competitive employment advantage.

• A 20-credit hour minor in chemistry: This option aims to increase the employment competitiveness of Mines graduates, especially those with an engineering focus. It also should strengthen graduates for entry into graduate programs that require an academic foundation in chemistry.

More than 400 students earn Dean’s List honor

More than 400 South Dakota School of Mines & Technology students were named to the Dean’s List for the 2013 spring semester. In order to merit a spot on the Dean’s List, students must earn a grade point average of 3.5 or higher for the semester. Full-time students must have earned a minimum of 12 credit hours that term, while part-time students must have earned between three and 11 credit hours that term.

About Legacy News

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