



SOUTH DAKOTA MINES®

An engineering, science and technology university

Department of Mechanical Engineering

Fall 2023

A Message from the Department Head



The 2023-24 academic year is off to a terrific start! In August, we happily welcomed our newest faculty member, Dr. Xuanhong An. Dr. An comes to us from San José State University in California. Prior to serving on the faculty at San José State, he successfully completed a three-year research associate post-doc at Princeton University. He received his PhD degree in mechanical and aerospace engineering from the Illinois Institute of Technology. Dr. An has expertise in aerospace engineering, specifically experimental and computational fluid dynamics. He's teaching courses to support our aerospace engineering minor and our core M.E. courses in thermo-fluid systems such as fluid mechanics, thermodynamics, and heat transfer.

Here's some data about our department. In each of the last four years, enrollment in mechanical engineering at South Dakota Mines has been increasing. From a total of 482 students in fall 2020 to a current total of 572. Last year we had a record number of female students in mechanical engineering, and this fall we set a new record. We currently have 61 female students enrolled in mechanical engineering. All of this enrollment growth is remarkable because nationwide enrollment in mechanical engineering, and college in general, is decreasing substantially. Enrollment in our graduate MS and PhD programs continues to be strong. We currently have three times the number of MS students and double the number of PhD students that we had in 2020.

Funded research activity is increasing substantially within the department. In the past two years annual research expenditures have more than doubled and are currently just below \$1M. We are successfully wrapping up our capital campaign to raise funds for the E.R.

Stensaas Laboratory Endowment. To date, we've raised more than \$1.1M. This endowment is critical to enable us to continue providing the hands-on, project-based learning experiences that prepare our graduates to be successful in the workplace.

Read on to learn about all of the great accomplishments of our mechanical engineering students, faculty, and staff. What a great time to be a Mechanical Engineering Hardrocker!

In closing, I would like to take this opportunity to wish everyone in your Hardrocker family a most joyous holiday season.

Dr. Pierre Larochelle, P.E.
Department Head

See the list of our [graduated students](#) and recent [research awards and publications](#).



South Dakota Mines' Department of Mechanical Engineering received a prestigious innovation in education award from ASME for its rigorous, project-based curriculum and commitment to preparing STEM professionals for real-world challenges.

Dr. Pierre Larochelle (right), accepted the Donald N. Zwiep Innovation in Education Award engineering at Campbell University. The event was held in March at the Caribe Hilton in San Juan, Puerto Rico.

Read more [here](#) and [here](#).

The [ME Doctoral Fellowship Program](#) was initiated in Fall 2019 from generous donations of ME alumni and faculty. This program offers up to \$40,000 in support to selected students. We are continuing our fundraising efforts and appreciate the support from alumni, industrial partners, and friends of the department. Make sure to choose “Other” in the Designation Field and type “ME Doctoral Fellowship” to direct your donation.



Vasilii Tseptsura, the machinist of the Department of Mechanical Engineering, [achieved a significant milestone on June 14, 2023](#), when he officially became a U.S. citizen at the Mount Rushmore National Memorial.

Born in Orenburg, Russia, Vasilii moved to Saratov at the age of 17. His journey to the United States began when his mother immigrated in 2006 and later applied for a family reunion visa. After six years of waiting, Vasilii moved to Rapid City, South Dakota, in 2017, securing his green card and his first job at the Civic Center.

Seeking further opportunities, he enrolled in the Precision Machining program at Western Dakota Tech, graduating with honors in May 2019. Shortly after, he joined Mines in June 2019. In December 2022, after five years in the U.S., Vasilii applied for citizenship, and, on June 14, 2023, he was sworn in as a U.S. citizen.

Several mechanical engineering faculty members were recognized during the 2023 Employee Service Awards ceremony for their dedicated years of service. Drs. Nickolaus Bruno and Pierre Larochelle, along with Mr. Ardell Knudson, received acknowledgment for their 5 years of service, while Dr. Aaron Lalley was honored for 10 years, and Dr. Jason Ash was celebrated for an impressive 20 years of service.



Dr. Cassandra Birrenkott, associate professor in South Dakota Mines' Department of Mechanical Engineering, has earned a coveted spot in the 2023-2024 cohort of the prestigious Executive Leadership in Academic Technology, Engineering, and Science (ELATES) program at Drexel University in Philadelphia. ELATES is a nationally recognized leadership development initiative aimed at empowering senior women faculty and their allies in STEM fields to take on influential roles within academia, with a strong focus on advancing gender diversity in STEM.

Dr. Birrenkott is enthusiastic about the opportunity to participate in ELATES and intends to bring her newfound knowledge and leadership skills back to South Dakota Mines. She has also received a scholarship from the Kern Entrepreneurial Engineering Network (KEEN) to cover her tuition for the program. KEEN's support has helped reinforce the university's commitment to producing well-rounded, multidisciplinary graduates equipped with both technical expertise and essential soft skills demanded by industry. Read more [here](#) and [here](#).



In May 2023, the Office of Faculty Development & Advancement (OFDA) was joined by the Provost to recognize individual faculty members who participated in the peer mentoring program and exemplars chosen by OFDA and by their peers. Drs. Micah Lande (left) and Weibing Xing (right) from the mechanical engineering department were recognized for their exceptional dedication to mentoring fellow faculty members.

Awards from the 2023 Design Fair

Best Poster Presentation

PLA Recycler

Most Innovative

Drift Trike

Best Virtual Presentation

Formula EV

Best Prototype

Surgical Tool



The 2nd annual Hardrocker Heritage Alumni Awards Gala took place on September 15 in the Surbeck Center Ballroom to recognize the 2023 alumni award recipients. Of the 11 recipients, four were mechanical engineering alumni. [David Braun](#) (top left) received the Guy E. March Medal, which honors Mines graduates for their positive impact on students, the university, and the alumni community, reflecting the compassionate spirit of Dr. Guy March. [Dave Berg](#) (top right) and [Roderick Sowders](#) (bottom left) received the Distinguished Alumni Award, acknowledging their exceptional contributions to their careers, communities, and South Dakota Mines. [Dr. Eirik Valseth](#) (bottom right) was honored with the ME Outstanding Recent Graduate award, which recognizes his remarkable career progress and recognition within a decade of graduation.

Congratulations to Dr. Daniel Rederth, lecturer in the mechanical engineering department, for being honored with the 2023 James and Connie Green CAMP Faculty Award. This award provides support to a faculty advisor involved in a national-level student project within any major, provided it includes mechanical engineering students. Dr. Rederth serves as the faculty advisor to the South Dakota Mines Formula SAE, Supermileage SAE, and Unmanned Aerial Systems (UAS) teams.



ME alumna Elise Flachs, who completed both her B.S. (Fall 2021) and M.S. (Spring 2022) degrees from South Dakota Mines and is now pursuing her Ph.D. at the University of Texas at Austin, has been awarded the prestigious 2023 National Defense Science and Engineering Graduate (NDSEG) Fellowship.

The NDSEG Fellowship is a competitive program that provides support to U.S. citizens pursuing doctoral degrees in science and engineering disciplines of military importance. Selected fellows, like Elise, have the opportunity to choose the U.S. institution where they'll pursue their doctoral degrees. This program is sponso-

red by the Air Force Office of Scientific Research (AFOSR), the Army Research Office (ARO), and the Office of Naval Research (ONR), under the direction of the Office of the Under Secretary of Defense for Research & Engineering.

She was awarded this fellowship based on her research proposal. As Elise explains, active cooling technology inside gas turbine engines is imperative for increasing the longevity of components and allowing high turbine inlet temperatures, thereby enhancing thermodynamic efficiency. Modern turbine engine airfoils feature internal cooling passages in which cool air absorbs heat along the length of the component. In addition, small holes allow a portion of the cool air to pass to the surface of the airfoil and provide a thin layer of protection against the mainstream gas. Many studies in open literature analyze how these film cooling holes perform under different conditions, and film cooling effectiveness has been observed to strongly depend on nondimensional quantities such as blowing ratio and velocity ratio.

The effect mainstream Mach number has historically been considered negligible for all film cooling studies due to early studies demonstrating only minor impact of Mach number on film cooling effectiveness for cylindrical holes. Recent experimental and computational work in our laboratory have explored the validity of this assumption for shaped hole geometries, and results indicate that film cooling effectiveness degrades significantly in the presence of high Mach number (i.e. engine realistic) flows. Thus, characterizing compressible effects is paramount to understanding the actual flow physics at realistic engine conditions for shaped film cooling holes. The proposed research aims to increase the present state of knowledge of Mach number effects on shaped film cooling hole performance through experimental and computational evaluation.

South Dakota Mines secured a notable win at the 2023 South Dakota Governor's Giant Vision Business Competition, taking first place and four of the top five positions in the student division. This achievement extends our impressive streak of success at the competition for a decade, with notable participation from two Mines mechanical engineering students in Vizion UAS, one of the winning teams. Read more [here](#).



With significant effort from Senior Lecturer Dr. Peter McKeon, the mechanical engineering department recently set up a new mechatronic makerspace called “The Reef.” The Reef is not only the new home for the mechatronic labs, but is a space available to all mechanical engineering students to support projects, complete with a custom-made welding station, a fully stocked tool chest, shelves of benchtop test equipment, and bins of motors, pumps, microcontrollers, linear actuators, and other common mechatronic project elements. Undergraduate student peer-mentors and graduate teaching assistants organize, staff, and decorate the space to make it a welcoming and helpful innovation hub for our department. Response has been overwhelmingly positive, and the room is often bustling with students working excitedly on their projects.



Mechanical engineering senior Jayden Johannsen earned his fifth Offensive Player of the Week award, setting a school record, following an outstanding five-touchdown performance that cemented his position as a top Division II quarterback. Read more [here](#).



South Dakota Mines has earned a place among the top 10 colleges recommended by students and alumni in the Wall Street Journal's 2024 Best Colleges in the United States rankings. Notably, it's the only university in South Dakota to make the list, and it's also ranked 31st in the nation for salary impact.

Read more [here](#).

The South Dakota Mines' mechanical engineering program offers an impressive ROI of \$618,994, as highlighted in this [article](#) discussing South Dakota's high rate of return on investment for public university degrees.



Mechanical engineering student Gretchen Noble became the first woman at South Dakota Mines to secure the esteemed Department of Defense (DoD) SMART Scholarship. Notably, her fellow mechanical engineering student, Bennet Outland, had received the same scholarship in the preceding year. This scholarship encompasses full tuition, mentorship, summer internships, a stipend, and a pathway to a promising career within the Department of Defense, highlighting the university's steadfast commitment to fostering STEM excellence.

Results were recently posted for the [2023 Spaceport America Cup](#) held north of Las Cruces, NM from June 19-24, 2023. The Mines Association of Rocketeers (MARS) team placed 32nd out of 119 teams overall. Much of that can be attributed to the 13th-highest score for their Project Technical Report and their efforts overall during the 2022-23 academic year. The team consisted of 6 ME senior design team members: (in the below-left picture, left to right) Elijah Meakins, Joshua Curry, and Payton Winsor, along with Cole Shepardson, Hayden Pszanka, and Luke Steffens. That was in addition to a number of multidisciplinary underclassmen students who reformed the MARS team and joined the CAMP organization.

The team had a successful launch to their apogee around 9,540 ft. Their goal was to make it to 10,000 ft, so they were close to their target apogee. At apogee, however, the plastic containers holding the black powder charges ruptured before all the black powder was ignited causing a fire instead of a large pressure wave to separate the rocket and deploy the parachutes. This issue becomes more critical at higher altitudes and was not encountered during ground-level ejection testing. Without separation, the rocket impacted the ground at over 500 mph. The GPS system provided a signal shortly before impact, which led the team to the debris field where they recovered portions of the rocket for evaluation. If the last step had occurred, including parachute deployment and recovery, the team could have secured 16th place overall. Regardless, the 32nd-place finish is respectable for a new team that provided a great foundation for future teams to continue.

The department expresses gratitude to Mark Rapf (pictured in the below-right photo with team members), the flyer of record, and extends thanks to numerous sponsors and supporters, including NASA South Dakota Space Grant Consortium, South Dakota Mines Student Association, B9 Creations, L3 Harris, Cape Lab, and CAMP.





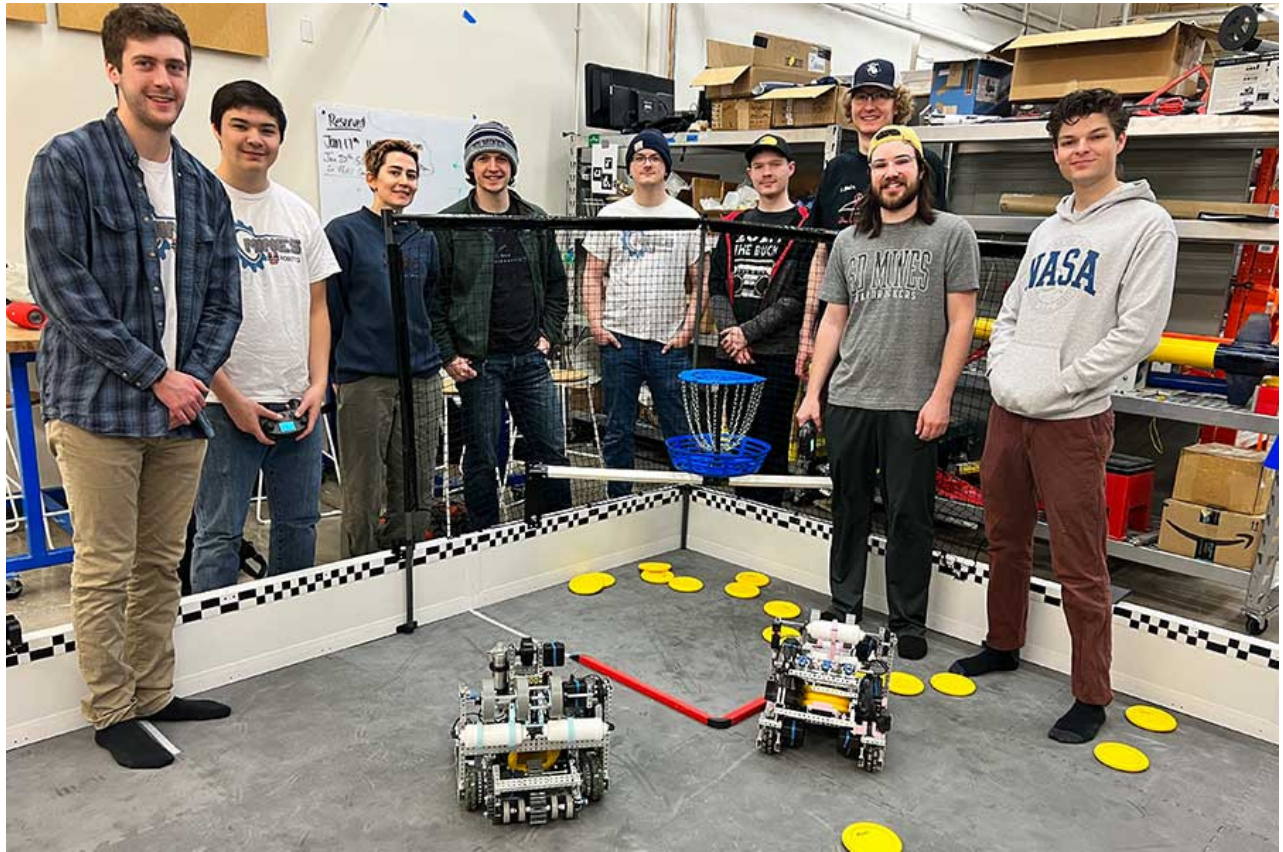
A team of South Dakota Mines 2022-23 senior design students has created the BeethoVAN, a mobile stage equipped with an indoor/outdoor stage, sound acoustics, and space for high-end classical instruments, including a grand piano. The project, funded by the Ludwick Family Foundation, aims to bring pop-up classical concerts to rural areas across the Northern Great Plains, allowing more people to experience this type of music and providing opportunities for students to perform and give back to their community. [Read more](#) about the BeethoVAN mobile stage and its mission to bring classical music to rural areas in the Northern Great Plains.

Pictured above are (left to right) Dr. Jason Ash and Mines mechanical engineering majors Logan Leader, Zach Mohr, Joseph Zoller, and Eric Moore with project sponsors Dr. Brett Walfish and Dr. Katie Smirnova, founders of the Rushmore Music Festival.



The South Dakota Mines Formula SAE Hardrock Racing Team had some recent accomplishments at the FSAE Michigan 2023 competition. The team performed exceptionally well throughout the event, with the car passing the technical inspection smoothly. The design judge awarded the team's new powertrain his highest score. Despite a setback when the axle broke and the frame cracked, the resilient Hardrock Racing Team quickly repaired the car within a tight timeframe of three hours. They managed to compete in three races to get points and had enough time to swap drivers and compete in all three events again to increase the scores. Impressively, all driving scores surpassed last year's competition.

Out of 114 teams (initially 121 registered), South Dakota Mines' Formula team secured an impressive 28th-place finish. Notably, their car, valued at \$42K, competed against much costlier vehicles in the range of \$250-300K. The judges consistently express their anticipation and appreciation for our small school's participation and strong performance. Our Formula SAE Hardrock Racing Team truly embodies the spirit of our institution.



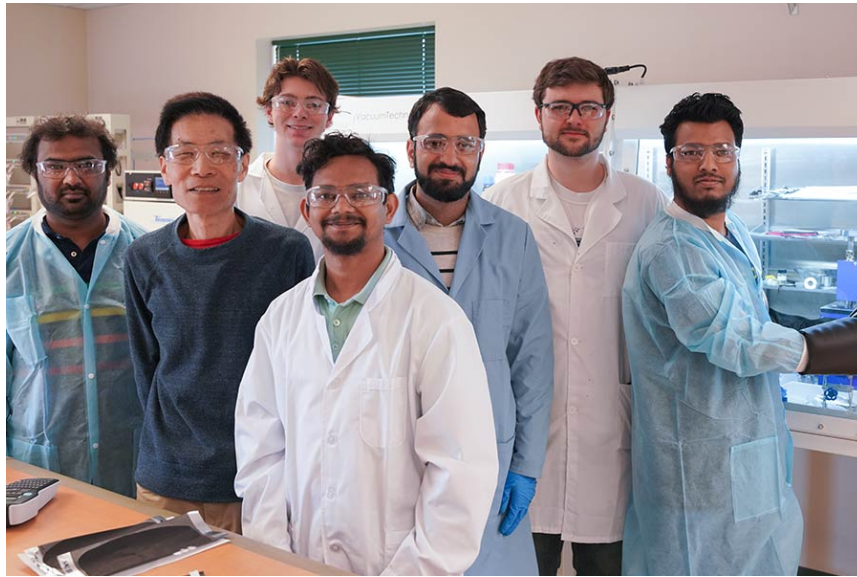
The South Dakota Mines Vex U Robotics team, renowned for their recent Community Service award win and recognition at the 2023 Leadership Hall of Fame and Student Leadership Awards ceremony, geared up to host the Robot Rumble, a regional VEX robotic competition. Over 20 high school teams from South Dakota, Colorado, and surrounding states converged at the South Dakota Mines campus on February 11, 2023, to compete in this exciting event. Read more [here](#).

Faculty Research Projects and Activities



ME Assistant Professor Dr. Prasoon Diwakar (pictured) and his team, including Dr. Neha Choudhary from South Dakota Mines and collaborators from Miami, have been selected as semi-finalists for the VITAL Prize Challenge. Their work, titled "Advancing STEM Learning through Research Laboratories in Schools," focuses on improving STEM education in K-12 schools by introducing in vivo laboratory experiences related to real-world problems. The team's proposal initially centered on machine learning, artificial Intelligence, and laser spectroscopy-based analytical tools to address local environmental issues in Miami.

The VITAL Prize Challenge, organized by the U.S. National Science Foundation in partnership with various foundations and Digital Promise, selected only 54 teams out of more than 300 applicants for the semi-final round. As semi-finalists, Dr. Diwakar and his team received a cash award of \$20,000 and will have three months to further develop their prototypes, with guidance from an educator co-design mentor. Their goal is to create educational technologies that support K-12 learning, learner variability, and historically excluded learners. This recognition highlights their dedication to advancing STEM education and learning innovations in schools, contributing to the betterment of education nationwide.



Weibing Xing, (second from left) and his research team (from left to right: Gulam Smdani, Weibing Xing, Haiden Studer, Wahid Hasan, Amir Razzaq, Chris Poches, and Salman Khan Mithil) in the Energy Storage Lab at South Dakota Mines.

Within the Department of Mechanical Engineering at South Dakota Mines, Dr. Weibing Xing has played a significant role in securing a \$750,000 NASA EPSCoR grant for pioneering research in lithium-sulfur batteries, thanks to a groundbreaking discovery involving a polymer-biocarbon cathode coating made from corn stalk residues. Dr. Xing's expertise in next-generation lithium batteries was instrumental in this innovation, which tremendously enhanced the charging capacity of current battery technology. With NASA's backing, Mines researchers, including Dr. Xing, are set to further optimize this game-changing technology for applications ranging from power plants to space missions. Read more [here](#).

Dr. Xing, along with Drs. Rajesh Shende and Edward Duke, was also interviewed on "In the Moment" on SDPB Radio about this NASA EPSCoR grant. Listen to the interview [here](#).

Pictured left to right: Drs. Edward Duke, Weibing Xing, and Rajesh Shende





Students from South Dakota Mines are leading the way in calibrating sensors for the Deep Underground Neutrino Experiment (DUNE) at the Sanford Underground Research Facility. DUNE, a monumental project involving a neutrino beam shot through the Earth to a particle detector 4,850 feet below ground, aims to unveil mysteries of neutrinos. Ian Helgeson (BSME 23) and Kole Pickner (MSME 22) played pivotal roles in constructing the photon detector monitoring system, enabling groundbreaking science, while Mines' physics doctoral graduate student Jairo Rodriguez led component installations. [Read the full story](#) to discover how these students' contributions are advancing the frontier of particle physics.



ME major Haiden Studer was chosen as one of ten participants in the 2023 Advanced Manufacturing for a Sustainable Energy Future Research Education for Undergraduates (REU), sponsored by the Center for Advanced Energy Studies (CAES) in Boise, ID. During this 10-week program, he collaborated with Dr. Dave Estrada on aerosol jet printing for devices in nuclear environments.



Pictured left to right: Kelvin Su, Taylor Kirkvold, Katherine Mathieu, Andy Perez, Blake Hyla, Macauley Haag, ME Assistant Professor and Stensaas Chair Dr. Micah Lande, and Associate Vice President for Research-Economic Development Joseph Wright.

Katherine Mathieu (BSME 23) and her AY 2022-23 senior design team of ME seniors Andy Perez, Kelvin Su, Blake Hyla, Taylor Kirkvold, and Macauley Haag were recognized with the 2023 Braun Student Inventor Award for their invention. Their project focused on recycling PLA-type plastic into 3D printable material, offering a sustainable solution for the world of 3D printing while earning them \$5,000 in cash and a free patent application as part of this award. Read more [here](#).



Congratulations to ME master's student Elijah Meakins for being awarded the Ivanhoe Excellence Fellowship for Academic Year 2023-2024 at South Dakota Mines. Each year, thanks to the generosity of donors, South Dakota Mines can offer valuable assistance to graduate students in the form of fellowships. Academic departments annually recommend students for these fellowships, and a committee from the Council of Graduate Education carefully selects the recipients from among these nominations.



Dr. Eirik Valseth (right) with his academic grandfather, the late Professor John Tinsley Oden (left), who is considered the father of computational mechanics, which is Dr. Valseth's field of research.

Dr. Eirik Valseth has been honored as the 2023 Outstanding Recent Graduate Student in Mechanical Engineering. He currently holds the position of Associate Professor of Scientific Computing at the Norwegian University of Life Science (NMBU) Department of Data Science and serves as a research associate at the Oden Institute at the University of Texas at Austin. He also serves as an affiliated researcher at the Simula Research Laboratory Department of Numerical Analysis and Scientific Computing. Prior to joining NMBU and Simula, he was a postdoc funded by an individual Marie Skłodowska-Curie Actions project, working with Dr. Kent-Andre Mardal at the University of Oslo.

He earned his mechanical engineering Ph.D. in December 2019 from the South Dakota School of Mines and Technology under the guidance of Dr. Albert Romkes. Dr. Valseth's focus is in developing finite element methods for partial differential equations, with a particular focus on applications like flood modeling, including hurricane storm surge and riverine flooding. His research extends to forecasting hurricane storm surge along the U.S. Gulf of Mexico and North Atlantic Coasts, as well as modeling for hydropower and flood prevention applications.

Dr. Valseth is a member of various professional societies, some of which include Pi Tau Sigma, the United States Association for Computational Mechanics, and the Norwegian Mathematical Society. His unwavering commitment to advancing the field of mechanical engineering and his pursuit of excellence make him a deserving recipient of this award.

Congratulations to our 2022-23 Outstanding Mechanical Engineering Junior!
Maxym Schuh (not pictured)

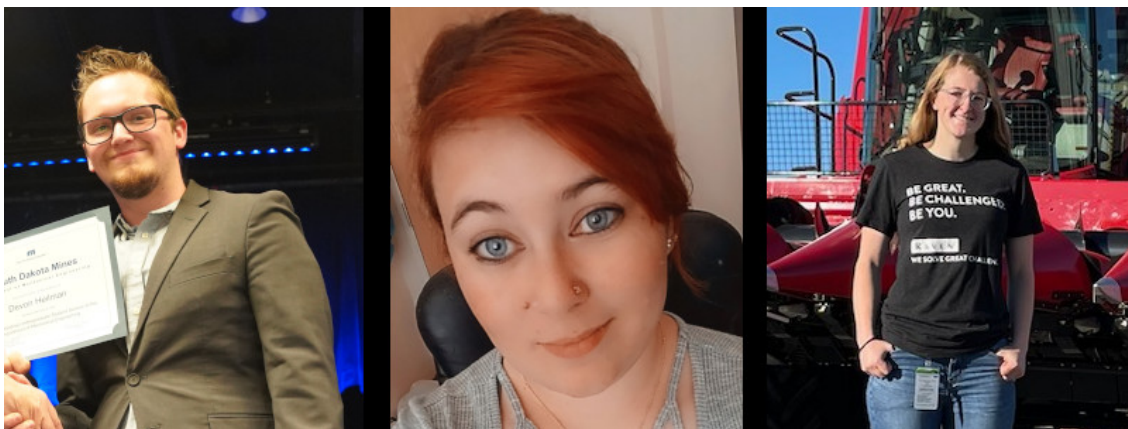


Congratulations to our 2022-23 Outstanding Mechanical Engineering Seniors!
Melissa May (top left), **Logan Melstad** (top right),
Bennet Outland (bottom left), and **Benjamin Ramseyer** (bottom right)



Congratulations to our 2022-23 Outstanding Graduate Student!
Margaret Thompson

Margaret also received the Outstanding Graduate Student Service to the ME Department award and was recognized as the Women's Cross-Country Scholar at the 72nd Honors Convocation.



Congratulations to the recipients of the 2022-23 Outstanding Undergraduate Student Service to the ME Department awards!
Devon Heilman, Taylor Kirkvold, Katherine Mathieu,
 and **Christopher Poches** (not pictured)

Congratulations to ME Ph.D. student Nicholas Pugh, who is a recipient of the [Lawrence J. Mazlack Fellowship](#) for Academic Year 2023-24.

The 2022-23 Academic Achievement Award was bestowed upon a select group of degree-seeking undergraduates who exemplify exceptional dedication to their studies. These outstanding mechanical engineering students, Luke Christen, Cameron Good, Joshua Hoffman, Armand Lannerd, and Elijah Meakins, were recognized for their remarkable commitment to academic excellence, having accumulated 100 or more credits while maintaining a flawless 4.0 cumulative grade point average. Their outstanding achievements were celebrated with honors at the 72nd Annual Honors Convocation, held on April 25, 2023, in the Surbeck Center Ballroom.



Pictured left to right: Nucor Mentors Tegun Thomson (BSME 25) and Portia Lenczowski (BSME 26)

Nucor Corporation has been one of South Dakota Mines' greatest supporters. One of the most impactful programs they have initiated is the Nucor Student Mentors program. Each year, students in the mechanical engineering program are selected as Nucor mentors. These students train and assist their fellow students in safety, manufacturing practices, and design for manufacturability. These students must possess outstanding abilities in leadership and project management and have an interest in training their fellow students. This academic year, the Nucor mentor scholars are Tegun Thomson and Portia Lenczowski. They both have worked in the Nucor Steel Tuscaloosa Alabama facility. Through their experience with Nucor, they have been able to develop their engineering skills including project, process, design, and modeling experience, with time in the melt shop being the highlight for each.

ME at a Glance

99%

South Dakota Mines ME graduate placement rate

\$69,546

Average starting salary for BS ME graduates

77%

Internship rate for South Dakota Mines students

\$20/hour

Average internship or co-op salary

572

Undergraduate Students – FA 2023

22

Graduate Students – FA 2023

14

Full-time Faculty

76

BS ME graduates in AY 2022-23*

8

MS ME graduates in AY 2022-23*

27

Total number of faculty publications and presentations in AY 2022-23

\$6.7M

Total amount of new research funding obtained in AY 2021-22



Faculty

Assistant Professors

Dr. Xuanhong An
Dr. Prasoon Diwakar
Dr. Joseph John Thalakkottor
Dr. Micah Lande (E.R. Stensaas Chair for Engineering Education)

Associate Professors

Dr. Jason Ash
Dr. Cassandra Birrenkott
Dr. Albert Romkes
Dr. Khosro Shahbazi
Dr. Weibing Xing (Pearson Endowed Chair)

Instructor

Ardell Knudson

Lecturer

Dr. Daniel Rederth

Professor

Dr. Pierre Larochelle (department head)

Professor of Practice

Dr. Aaron Lalley

Senior Lecturer

Dr. Peter McKeon

Staff

Brittany Brzozowski – Secretary
Leslee Moore – Program Assistant I
Vasilii Tseptsura – Machinist (Equipment Technician)

*Summer 2022, Fall 2022, and Spring 2023

Spring 2023 Career Fair

178 companies recruited

117 recruited ME students

Fall 2023 Career Fair

221 companies recruited **136**

recruited ME students

FOR MORE INFORMATION

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