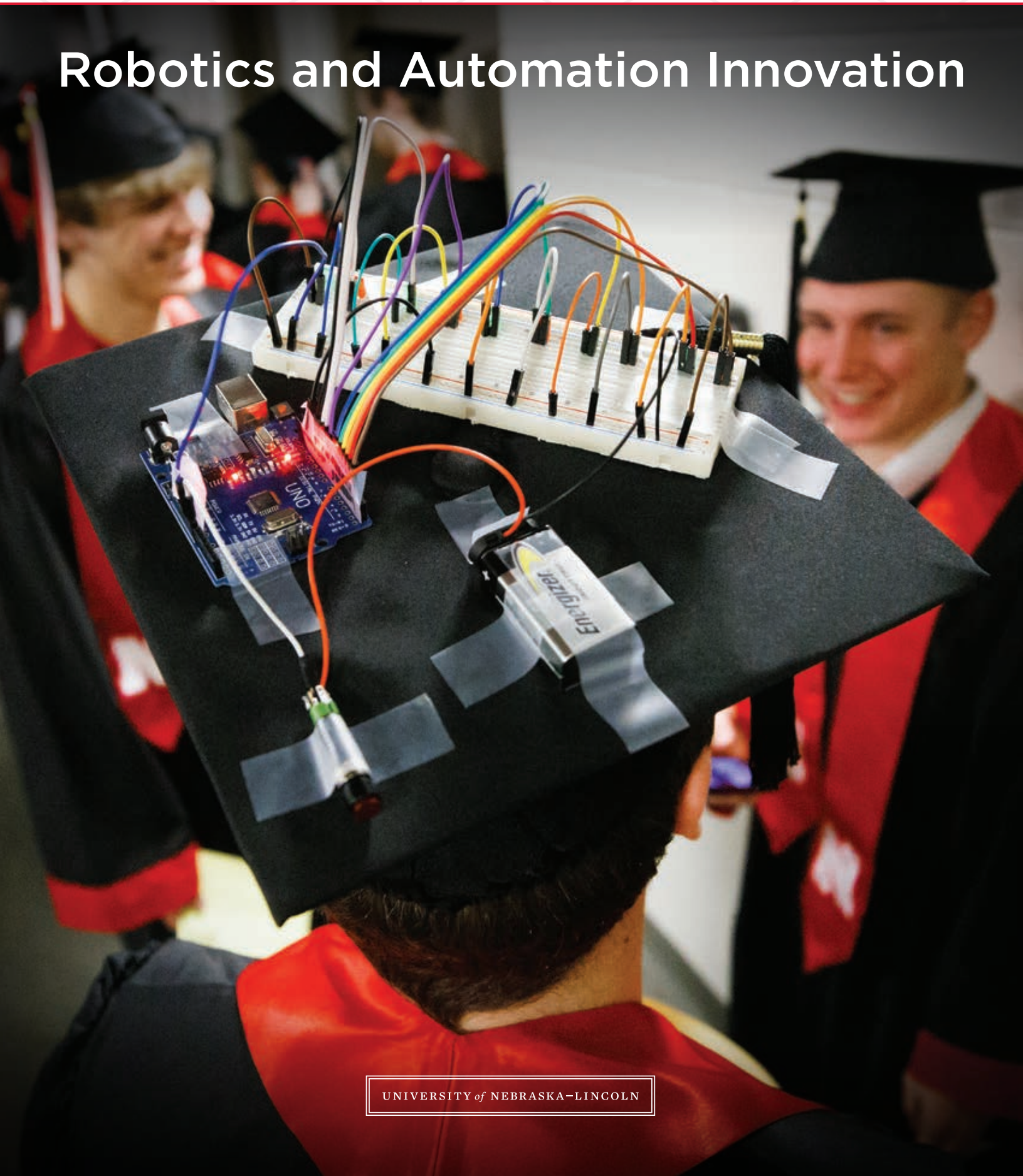


# Robotics and Automation Innovation



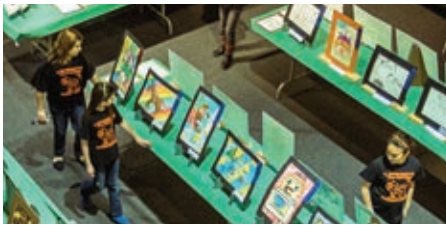
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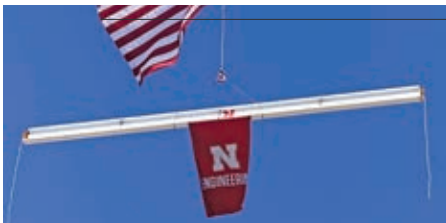
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## ENGAGE ON SOCIAL



Keep up to date with College of Engineering happenings using your favorite social media apps. Follow us on LinkedIn to connect with alumni, students and faculty! Get connected by following University of Nebraska-Lincoln College of Engineering on LinkedIn, then use the hashtag **#NebEngineering** and join in the conversations. Use the **#NebEngineering** hashtag on Instagram (@nebengineering) when following the College of Engineering or join the fun on Facebook by going to Nebraska Engineering's Facebook page and hitting "Like."

Engage today. It's a great way to keep in touch with the College of Engineering, see what students are accomplishing, and connect with fellow alumni!



## ENGINEERING AT NEBRASKA Winter/Spring 2023



On the cover and inside the magazine (page 10), we highlight robotics engineering and the impact robotics and automation will have on Nebraska agriculture and manufacturing. Whether it's to keep people safe or develop more efficiency, robotics is the future of the workforce.


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 University of Nebraska-Lincoln  
College of Engineering



Several activities kept students, faculty and staff busy during the academic year 2022-23, including (upper left) Student Organization Fairs where Husker Racing proved to be a popular booth among engineering students. Career Fairs offer engagement opportunities with companies like Schemmer and their talent acquisition and development strategist Lona Smart; Benesch and their employees Jessica Smith and Amin Hosseini Zadeh; and HDR hosting a table during a recent Durham School Career Fair. The Engineering Football Tailgate was a destination for alums like Larry ('72, '77) and Ramona Reed (bottom left) prior to the Indiana game last fall where Dean Lance C. Pérez (bottom right) visited with guests during the two-hour event.



# DEAN'S MESSAGE

## LANCE C. PÉREZ

Dean, College of Engineering

Omar H. Heins Professor of  
Electrical and Computer Engineering



**W**elcome to the Winter/Spring 2023 issue of the ENGINEERING AT NEBRASKA alumni magazine. We are so grateful to have more than 26,000 alumni around the world and hope you all enjoy this issue, which includes exciting developments in the college and at the university.

The College of Engineering is taking a major role in a \$25 million federal award that will push the boundaries of robotics innovation and serve as an economic driver for Nebraska. The proposal was developed and managed by Invest Nebraska Corporation, a state-level venture development organization led by Dan Hoffman. Called the Heartland Robotics Cluster, this project will build on the college's strengths in varying aspects of robotics and will enable it to become a national leader in several robotics applications. The project includes \$9.3 million to build out robotics-related research and teaching spaces in Kiewit Hall, Scott Engineering Center and Splinter Labs. Other partners on the project are Nebraska Innovation Studio, The Combine, the Nebraska Manufacturing Extension Partnership, Northeast Community College and Metro Community College. The project is just one example of how the college and our partners can successfully compete at the national level.

We are very excited to announce the Catherine and Richard C. Schmoker Presidential Chair in Systems Engineering. This endowed Presidential Chair, only the second of its kind in the College of Engineering, was established at the University of Nebraska Foundation to enable the college to recruit an accomplished expert to build academic programs and research initiatives in systems engineering. Systems engineering involves defining, synthesizing, analyzing, designing and evaluating complex systems containing hardware, software and human elements across their life cycles. It has wide applications across a variety of fields, including computer and communications networks, financial systems, agriculture and national security. We are extremely grateful to the Schmokers for their generous gift and their commitment to supporting our faculty.

Finally, the University of Nebraska system launched Only in Nebraska: A Campaign for Our University's Future. This campaign is a historic effort to encourage at least 150,000 benefactors to give \$3 billion to support students, faculty, academic programs and research to address the needs of the state and the nation. Strengthening the College of Engineering is a top priority of the campaign. We hope you, like the Schmokers, will want to be a part of this incredibly exciting time in the history of the college.

I hope you enjoy the stories in this issue and, as always, please reach out to us to share your good news and if you have any questions.

Sincerely,

A handwritten signature in black ink that reads "Lance C. Pérez". The signature is fluid and cursive, with the first letters of the first and last names being capitalized and prominent.

Lance

# COLLEGE OF ENGINEERING HIGHLIGHTS NEW AND CURRENT NAMED PROFESSORSHIPS

This fall, 10 faculty in the College of Engineering were honored with a named professorship. An endowed professorship is the highest academic award and honor that a college can bestow on a faculty member. Named professorships are also an enduring tribute to the donors who establish them. A total of 28 faculty now hold college professorships. Five additional faculty have university professorships.

Funds are provided by private gifts to the University of Nebraska Foundation to support distinguished faculty in the College of Engineering. Professorships provide faculty with stipends and discretionary funds and enable the recipients to further develop their teaching and research interests.

“Named professorships are also essential to attract and retain the best faculty,” said Lance C. Pérez, dean of the College of Engineering. “We are fortunate to have donors who understand the importance of high quality faculty to deliver on our teaching and research mission.”

The Fall 2022 class includes new professorships supported by the family of Ray Fauss, Wilmer J. and Sally L. Hergenrader, Richard L. McNeel, and Robert F. and Myrna L. Krohn. With the support of these generous donors and others, the college was able for the first time to award four outstanding associate professors with named professorships.

## Continuing Professorships

**Shannon Bartelt-Hunt**, Donald R. Voelte and Nancy A. Keegan Chair of Civil and Environmental Engineering

**Yuris Dzenis**, R. Vernon McBroom College Professor of Mechanical and Materials Engineering

**Shane Farritor**, David B. and Nancy K. Lederer Professor of Mechanical and Materials Engineering

**Natale Ianno**, Lott Professor of Electrical and Computer Engineering

**Daniel Linzell**, Leslie D. Martin Professor of Civil and Environmental Engineering

**Yongfeng Lu**, Lott University Professor of Electrical and Computer Engineering

**Lance C. Pérez**, Omar H. Heins Professor of Electrical and Computer Engineering

**Wei Qiao**, Clyde Hyde Professor of Electrical and Computer Engineering

**Kamlakar P. Rajurkar**, Distinguished College Professor of Mechanical and Materials Engineering

**Ravi Saraf**, Lowell E. and Betty L. Anderson Professor of Chemical and Biomolecular Engineering

**Mathias Schubert**, J.A. Woollam Distinguished Professor of Electrical and Computer Engineering

**Hamid Sharif**, Charles J. Vranek College Professor of Electrical and Computer Engineering

**Jeffrey Shield**, Robert W. Brightfelt Professor of Mechanical and Materials Engineering

**Joseph Turner**, Robert W. Brightfelt Professor of Mechanical and Materials Engineering

**Hendrik Viljoen**, College Professor of Chemical and Biomolecular Engineering

**Lily Wang**, Charles W. and Margre H. Durham Distinguished Professor of Architectural Engineering and Construction

**Marilyn Wolf**, Elmer E. Koch Professor of Engineering

**John A. Woollam**, George Holmes Distinguished Professor of Electrical Engineering

## Fall 2022 New Professorships

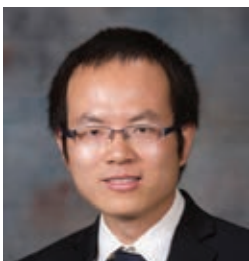


### **RICHARD L. McNEEL ASSOCIATE PROFESSOR OF CHEMICAL AND BIOMOLECULAR ENGINEERING**

**Vitaly Alexandrov, Ph.D.**

*Chemical and Biomolecular Engineering*

Research interests for Dr. Alexandrov include computational/theoretical electrochemistry and materials science, electrocatalysis and batteries. He received an NSF CAREER Award and an American Chemical Society (ACS) Petroleum Research Fund Award.



### **R. VERNON McBROOM ASSOCIATE PROFESSOR OF MECHANICAL AND MATERIALS ENGINEERING**

**Bai Cui, Ph.D.**

*Mechanical and Materials Engineering*

Dr. Cui's research primarily focuses on developing advanced materials that can withstand extreme environments for use in next-generation nuclear energy, petroleum, and aeronautic systems. He is a member of the Minerals, Metals & Materials Society, American Ceramic Society, American Nuclear Society and the International Society for Optics and Photonics.



### **ROSS McCOLLUM ASSOCIATE PROFESSOR OF COMPUTING**

**Brittany Duncan, Ph.D.**

*School of Computing*

Dr. Duncan is a leader in the field of unmanned systems and interactions between humans and robots. Her research also includes artificial intelligence and she received an NSF CAREER Award to study foundational interactions between novice users and unmanned aerial vehicles.



### **RAY FAUSS PROFESSOR OF CIVIL AND ENVIRONMENTAL ENGINEERING**

**Bruce Dvorak, P.E., Ph.D.**

*Civil and Environmental Engineering*

Dr. Dvorak's research interests include environmental engineering, physical-chemical treatment processes, life cycle assessment and pollution prevention and environmental sustainability for industry. He has served on the boards of directors for the State of Nebraska Board of Engineers and Architects and the American Water Works Association.



### **KEITH W. KLASSMEYER CHAIR OF CIVIL AND ENVIRONMENTAL ENGINEERING**

**Nathan Huynh, Ph.D.**

*Civil and Environmental Engineering*

The director of the Nebraska Transportation Center, Dr. Huynh has developed and maintained a strong research program in transportation engineering. His areas of research expertise include supply chain and logistics, intermodal network design, freight transportation systems, civil infrastructure systems, and health care systems.

CONTINUED ON NEXT PAGE



**ROBERT F. AND MYRNA L. KROHN ASSISTANT PROFESSOR OF BIOMEDICAL ENGINEERING**

**Ryan Pedrigi, Ph.D.**

*Mechanical and Materials Engineering*

Dr. Pedrigi's research explores the importance of mechanics in regulating cells to improve medicine through the development of new therapies, medical devices, and computational tools. Through more than 15 years in research, he has developed an expertise in biomechanics and mechanobiology that includes an NSF CAREER Award.



**DALE M. JENSEN CHAIR IN COMPUTING**

**Mehmet Can Vuran, Ph.D.**

*School of Computing*

Consistently among the most-cited researchers in computer science, Dr. Vuran is also a National Strategic Research Institute (NSRI) Fellow and a Fellow of the Daugherty Water for Food Institute, and earned an NSF CAREER Award. His primary research focus areas include wireless underground communications, agricultural Internet of Things (Ag-IoT), embedded and autonomous systems, and cyber-physical networking.



**WILMER J. AND SALLY L. HERGENRADER PRESIDENTIAL CHAIR OF MECHANICAL AND MATERIALS ENGINEERING**

**Jian Wang, Ph.D.**

*Mechanical and Materials Engineering*

Dr. Wang's areas of research include multiscale materials modeling, interface mechanics and engineering, fabrication and mechanics of nanostructured materials and nucleation, and the role of defects in solids. He is a Fellow of ASME and ASM International and received the Rising Star Award from Materials Today.



**ROBERT F. AND MYRNA L. KROHN ASSOCIATE PROFESSOR OF BIOMEDICAL ENGINEERING**

**Ruiguo Yang, Ph.D.**

*Mechanical and Materials Engineering*

Dr. Yang's research primarily focuses on relationships between cells - how they are joined, how they communicate, and their resilience - with a goal of providing the foundation for new medical breakthroughs in areas such as drug delivery and treatments for diseases. He received an NSF CAREER Award and a National Institutes of Health COBRE Early Investigator Award.



**RICHARD L. McNEEL ASSOCIATE PROFESSOR OF ARCHITECTURAL ENGINEERING AND CONSTRUCTION**

**David Yuill, Ph.D.**

*The Durham School of Architectural Engineering and Construction*

Dr. Yuill's areas of research include high-performance sustainable buildings, Smart Building technology, energy conservation through smart buildings and fault detection and diagnostics (FDD) in HVAC systems. He is a voting member on numerous ASHRAE Technical Committees and is also a member of IBPSA and the Consortium for HVAC Equipment Diagnostics.



# NEBRASKA ENGINEERING RECEIVES \$2M GIFT

Endowed faculty presidential chair in systems engineering established.



A \$2 million gift from alumna Kit Schmoker and her late husband, university alumnus Dick Schmoker, will create an endowed faculty chair in systems engineering in the college.

The Catherine and Richard C. Schmoker Presidential Chair in Systems Engineering was established at the University of Nebraska Foundation to create an endowed fund that will permanently support a faculty leadership position.

“Longtime university supporters Kit and Dick Schmoker have provided a game-changing gift for UNL, one that is directly tied to what we are striving to achieve in workforce development,” said UNL Chancellor Ronnie Green. “The Schmoker Presidential Chair sets the university on a strong path to becoming a national leader in the critical field of systems engineering while enhancing the economic competitiveness of the state.”

Systems engineering involves defining, synthesizing, analyzing, designing and evaluating complex systems containing hardware, software and human elements across their lifecycles. Systems engineering has wide applications across a variety of fields, including computer and communications networks, financial systems and large collections of internet enabled devices.

Lance C. Pérez, dean of the College of Engineering, said a prestigious presidential chair will enable the college to recruit an “exceptionally qualified” senior faculty member to lead its systems engineering program.

“The Schmoker Presidential Chair will advance both our education and research capacity in systems engineering,” Pérez said. “This will enable the university to be a partner in addressing national security needs associated with the next generation of nuclear command, control and communications infrastructure. It also has strong applications in cyberinfrastructure for agriculture, finance, transportation and many other industries.”

Careers in systems engineering are anticipated to be especially needed in Nebraska. The U.S. Department of Defense has tasked the U.S. Strategic Command located

at Offutt Air Force Base near Omaha, Nebraska, with modernizing the military’s Nuclear Command, Control and Communications (NC3) infrastructure.

“Dick and I wanted to create an innovative and lasting new vision for the University of Nebraska–Lincoln,” Kit Schmoker said. “The Schmoker Presidential Chair in Systems Engineering is an exciting opportunity for new leadership in the College of Engineering for systems engineering. It represents a new vision reaching new horizons. A new vision for excellence. A new vision for students. A new vision in engineering progress. A new vision moving forward at Nebraska.”

A Presidential Chair Award, with its support of an endowed fund, is the highest academic honor the university can confer on its faculty members and recognizes those who are a top scholar within a discipline. It enables the university to award faculty members with an annual stipend for salary, research and program support. Recipients of the award are selected based on outstanding teaching and research ability, academic promise and career accomplishments.

Richard “Dick” Schmoker graduated from the UNL College of Arts and Sciences in 1962 and from the UNL College of Law in 1964. Catherine “Kit” (Stuart) Schmoker graduated from the College of Education and Human Sciences in 1964. The two married in Lincoln in 1963 and moved to Edina, Minnesota, where Dick Schmoker worked his entire career with Faegre & Benson. Dick Schmoker died on April 3, 2022, at age 81.

Over the years, the Schmokers have provided philanthropic support to the College of Law, including funding for faculty, educational facilities and the endowed Richard C. and Catherine Stuart Schmoker Professorship. They also generously supported the Kit and Dick Schmoker Reading Center within the UNL College of Education and Human Sciences that provides reading and writing tutoring to children, and they provided a major gift toward construction of the Adele Coryell Hall Learning Commons on the UNL City Campus.

# ROBOTICS IN THE HEARTLAND

## Robotics curriculum, degree program a result of \$25 million federal grant

Addressing statewide manufacturing workforce challenges, growing a robotics engineering curriculum at UNL and augmenting agricultural technology opportunities for farmers and ranchers is the future of robotics and automation in Nebraska thanks to a \$25 million federal grant awarded to the Heartland Robotics Cluster in 2022.

As part of the U.S. Department of Commerce's \$1 billion Build Back Better Regional Challenge, the Heartland Robotics Cluster has been established at Nebraska Innovation Campus in Lincoln to assist educators and manufacturers in the state with many innovative initiatives, including the formalization of an undergraduate and graduate degree program in robotics at the College of Engineering. With only eight robotic engineering undergraduate programs in the U.S., the impact of a robotics curriculum at UNL will feature research and development labs with general robotics research that will teach and train students to increase Nebraska's economic output for agriculture and manufacturing.

"We don't have enough people who understand agriculture and also technology," said Santosh Pitla, Ph.D., associate professor, advanced machinery systems. "A cluster like the HRC will bring students from diverse backgrounds to train in the ag tech space. This is a catalyst we need, and we need more of these catalysts to create a next generation workforce."

A primary coalition partner with the HRC, the College of Engineering will invest its share of the federal award, totaling approximately \$9.3 million, in various resources such as hiring faculty who will create new courses for a B.S. in robotics degree, equipment to support instructional programming and research and development activities, and construction of a robotics lab in the lower level of Scott Engineering Center to accommodate everything from robotics construction and demonstrations to UAV (drones) flying and training. This facility will also support research and development from other colleges and departments across campus, using funds generated from projects to support ongoing operations.

"We anticipate that this will become a destination degree program that attracts students from beyond the state and will provide new channels for growth of the Nebraska workforce," said Mark Riley, Ph.D., associate dean for

research and project lead with Invest Nebraska on behalf of the College of Engineering. "It's a tremendous opportunity for all entities involved in the coalition to enhance automation and grow robotics but we're excited to take this even further and educate the next generation of robotics engineers in Nebraska and the Midwest."

Additionally, the college will utilize funding to further educational opportunities for high school students in underserved areas by developing a summer bridge program to support robotics training and help students overcome potential hardships associated with college-specific courses like math, physics and computing.

"As a part of our teaching and education mission, we train students but if they don't have opportunities here, they're going to move out of the state," added Pitla, whose areas of research include agricultural robotics and embedded control applications in machine automation. He also serves as an advisor to the UNL robotics team, HuskerBots. "The big thing with robotics and automation is how can we amplify a person. If people can manage 10 machines or working by themselves but they are just monitoring for problems then you free up time so that they can do other, more quality things."

One of 21 projects selected (out of 529 applications from all 50 states), the Heartland Robotics Cluster, led by the Invest Nebraska Corporation and Dan Hoffman, will receive \$25 million in funding awarded from the American Rescue Plan and administered by the Commerce Department's Economic Development Administration (EDA). In addition to establishing a robotics degree program at UNL, the grant will be used to:

- Construct automation demonstration space and programs for Nebraska manufacturers, led by the Nebraska Manufacturing Extension Partnership
- Form an automation fabrication lab on the campus of Northeast Community College in Norfolk
- Develop an urban ag/robotics outreach and training program at Metro Community College in Omaha
- Expand the robotics maker's space at Nebraska Innovation Studio



(FROM LEFT) AARON HAAKE, ADVISOR SANTOSH PITLA, CHEETOWN LIEW, HERVE MWUNGUZI AND KRISHNA MUVVA STAND BEHIND THE ROBOT THEY DESIGNED IN 2022.

## UNL Robotics Club harvesting recognition

The UNL Robotics Club, also known as HuskerBots, has only been in existence since 2017 but it has already harvested the recognition that comes with a national championship.

The team took first place at the American Society of Agricultural and Biological Engineers (ASABE) Robotics Student Design Competition in July 2022 at the group's annual meeting in Houston, Texas.

Advised by Santosh Pitla, associate professor of biological systems engineering, the team of students — CheeTown Liew, Herve Mwanguzi, Aaron Haake, Krishna Muvva, Salem Nyacyesa Rumuri, Pacifique Mucyo, Theo Joseph and Hesan Sedaghat — was tasked with designing a robot that could harvest three rows of cotton, with each row containing 11 plants, on an 8-foot-by-8-foot field.

The eight teams in the competition included entries from across the country, including Ivy League schools.

Liew, who was one of the founders of the club six years ago, said having a core group from these formative years and the experiences learned from past competitions were instrumental in the 2022 success.

“The robotics team had a humble beginning, without much knowledge in robotics, and we brute forced through the challenges and made many mistakes,” Liew said. “I think one of the reasons for our achievement came from many years of experience, which we built on the past failures and (lessons) learned from the other winning teams.”

The Robotics Club is an engineering student organization that focuses on design, development and building of robots and robotics applications. Liew said having team members from multiple disciplines — mechanical, electrical and agricultural engineering and computer science — led to successful teamwork and a winning design.

Mwanguzi said the work to prepare for the ASABE competition and the robot's performance reinvigorated his love for robotics.

“I was always interested in robotics — and then I found you can do real-world stuff,” he said. “I enjoy when things are not working and then it finally works.”



**THE ROBOTICS CLUB INVITES STUDENTS TO JOIN DURING THE FALL CLUB FAIR.**

## Gilmore's passion for teaching, learning has impacted robotics in Nebraska



GILMORE

After eight years as a control systems engineer — with degrees in electrical engineering and mathematics — Alisa Gilmore decided it was time for a change and pursued a career in education. She moved to Omaha, met with Professor of Electrical and Computer Engineering Bing Chen through a mutual contact and told

him, “I want to do what you do.”

Following the retirement of a senior lecturer working in the then-Department of Computer and Electronics Engineering housed in the Peter Kiewit Institute (PKI) on UNO's Scott Campus, Gilmore was hired as a senior lecturer in 2003. Soon after, she was asked to create a class in robotics.

Her engineering background served her well in this new endeavor. “I look at everything as a system with control outputs and inputs. I take a systematic approach to all I do,” she said.

Gilmore, now associate professor of practice, did a “deep dive” into robotics, including reading “a lot of books on robotics history and control architectures, including behavior-based programming.” As her expertise developed, she helped expand use of the CEENBoT by creating the first mobile robotics course in the department that she still teaches today. This educational robot developed by Chen and others was given to every new major in computer engineering and electronics engineering on Scott Campus.

In 2006, a grant acquired by Chen and members of the UNO College of Education provided training in robotics for middle school teachers to stimulate students' interest in science and math, Gilmore said. After three cohorts, they held a culminating event at PKI. Then, in 2010, they partnered with the Nebraska FIRST® LEGO® League and created the Nebraska Robotics Expo, which was held at the Strategic Air Command and Space Museum in Ashland the next 11 years.

As director of the Expo from 2011-2022, Gilmore estimates that close to 1,000 teachers and students attended annually, along with more than 1,500 spectators. The Expo included the First LEGO League and the CEENBoT Robotic Showcase, which in 2020 exceeded 500 Nebraska youth and 140 K-12 teams. Students were primarily from the eastern part of the state, mainly the Omaha metro area, Gilmore noted. In its later years, a “Creative Visual Arts Expo” category was included for creative displays from students. Many current Nebraska Engineering students were integral in helping ensure the Expos were successful.

Due to the COVID-19 pandemic, virtual expos were held in 2021 and 2022, with the team working with Prairie STEM to provide self-contained kits that teachers and students could use. Hands-on STEM lessons — including all of the materials, instructions, videos, etc. — were available. More than 1,000 STEM kits were delivered to teachers and students.

“One benefit of the virtual expos was that we were able to expand the reach of the project's impact across Nebraska, with funding to reach more than 25 zip codes,” she said.



Unfortunately, due to funding limitations provided primarily from grants and industry, there will not be an Expo in 2023, but Gilmore is hopeful the event can continue in the future.

“The Nebraska Robotics Expo is a proven concept. We have years of feedback from teachers of its impact in spurring kids’ interest and engagement in STEM. Maybe we can revamp or reinvent how it works,” she said.

As for Gilmore, she is pivoting her time and energy into her teaching, along with several new endeavors in the area of assessment.

“The ECE is a two-campus department, so we offer dual classes virtually, which can be challenging for the faculty and the students,” she said. “But it’s all about problem solving and putting the right systems into place to help the students better visualize and absorb the information, no matter where they are located.”

When the pandemic drove the changeover to widespread virtual classes, Gilmore was a step ahead of many other faculty, with videos and online learning materials already in place for her students.

And she serves on an interdisciplinary committee of faculty across universities regarding the future of robotics and mechatronics education, which helps support robotics curriculum development across the country.

Along with her teaching responsibilities, Gilmore oversees the assessment process in the Department of Electrical and Computer Engineering for the upcoming ABET reaccreditation. For the past six years, she has chaired the Continuous Improvement of Teaching and Learning Committee for the College of Engineering, including creating surveys and other measurements to improve teaching and assess student learning and outcomes. She is also serving as an ABET program evaluator for the next five years to assess other college’s programs.

“This is not a direction I could have envisioned when I began this journey in 2003,” Gilmore said. “When I started learning about assessment, this was a new challenge for me, one I have joyfully embraced and ran with.”

THE STRATEGIC AIR COMMAND & AEROSPACE MUSEUM HOSTED THE NEBRASKA ROBOTICS EXPO FROM 2010-2020, WITH MORE THAN 1,000 TEACHERS AND STUDENTS PARTICIPATING EACH YEAR.



**A PARTICIPANT PRACTICES PRIOR TO A COMPETITION DURING THE ANNUAL NEBRASKA ROBOTICS EXPO.**

# FARRITOR PREPARES SURGICAL ROBOT FOR SPACE STATION

**NASA, a long-term supporter of this research, awarded Virtual Incision \$100,000.**

This past summer, NASA awarded \$100,000 to Virtual Incision, a start-up company co-founded by Nebraska Engineering's Shane Farritor, to prepare a surgical robot for a 2024 test mission in outer space.

"NASA has been a long-term supporter of this research and, as a culmination of that effort, our robot will have a chance to fly on the International Space Station," said Farritor, David and Nancy Lederer Professor of Engineering.

Farritor is chief technology officer of Virtual Incision, which is based on Nebraska Innovation Campus. For nearly 20 years, he and his colleagues have been developing the tiny surgical robot known as MIRA, short for "miniaturized in vivo robotic assistant."

Sometime in 2023, Farritor and engineering graduate student Rachael Wagner will complete their preparations - writing software, configuring MIRA to fit inside a space station experiment locker and exhaustively testing the device to make sure it's robust enough to survive launch and its systems will perform as anticipated in space.

Then, they will wait a year or so for the robot to get its turn aboard the station.

"As people go further and deeper into space, they might need to do surgery someday," Farritor said. "We're working toward that goal."

MIRA has two key advantages. First, it can be inserted through a small incision, enabling doctors to perform abdominal surgery in a minimally invasive manner. In previous tests, surgeons have successfully used the device to perform colon resections.

Secondly, the technology could allow surgeons to work remotely — perhaps someday repairing an astronaut's ruptured appendix on a mission to Mars or removing shrapnel from a soldier injured by an IED thousands of miles distant.

"The astronaut flips a switch, the process starts, and the robot does its work by itself," Farritor said. "Two hours later, the astronaut switches it off and it's done."

In a previous experiment, retired NASA astronaut Clayton Anderson took the robot's controls while at the Johnson Space Center in Houston, directing MIRA to perform surgery-like tasks in an operating room 900 miles away at the University of Nebraska Medical Center in Omaha.

During its upcoming trip aboard the space station, MIRA will work autonomously, without the guiding hand of a doctor or an astronaut, cutting tautly stretched rubber bands and pushing metal rings along a wire to simulate movements used in surgery.



**RACHAEL WAGNER EXPLAINS A ROBOTIC SURGERY DEVICE TO UNDERGRADS VICTORIA NELSON (LEFT) AND DAVID RYAN (CENTER), AS SHANE FARRITOR LISTENS IN.**

# ROBOTIC MAPPING AIDS IN INSPECTIONS OF GAS PIPELINES

Providing more accurate data for decision-making.



**ZHIGANG SHEN, CONSTRUCTION MANAGEMENT ASSOCIATE PROFESSOR, USES AN UNDERGROUND AUTONOMOUS ROVER TO HELP DETECT POTENTIAL PROBLEMS INSIDE NATURAL GAS PIPELINES.**

For more than six years, Zhigang Shen and a team of College of Engineering researchers have taken to the air and used eagle-eyed infrared image processing technology and 3-D mapping to detect hidden defects in the concrete pavement of Nebraska's bridge decks.

Now, Shen's team is developing an autonomous rover that goes underground to sniff out potential issues from inside natural gas pipelines. The same technology, Shen said, could be applied to inspecting pipes that transport other fuels, stormwater and wastewater.

The U.S. Department of Transportation's Pipeline and Hazardous Materials Safety Administration has provided funding for the two pipeline inspection projects that have led to technologies that would make inspections much more efficient and allow industry and government agencies to make faster and more well-informed decisions about pipe health and safety.

"We aren't fixing the problems, but we're giving people better and more accurate data for decision-making than traditional methods that have been used for decades," said Shen, associate professor in the Durham School of Architectural Engineering and Construction.

Those methods, especially on bridge decks, were often time-consuming and expensive – for example using hammer sounding to detect delaminations. This requires a laborious, inch-by-inch grid approach with workers tapping on the concrete and listening for sounds that could indicate cracks in the concrete.

For bridge inspections, the team uses unmanned aerial vehicles (also known as UAVs or drones) and infrared cameras that can see up to eight inches deep into thick concrete structures and utilize computers that process higher-resolution images and create accurate defects maps that pinpoint the delaminations.

A massive drone carries a camera and accessories that weigh about 20 pounds and then flies the length of the bridge at a height of 40 feet or so above the concrete deck. The mobility and speed of the system, Shen said, can allow engineers to examine and model 10 decks in one day if the bridges are located close to each other.

In pipelines, a six-wheeled rover carries a depth camera array invented by the team that both examines and maps the pipes for corrosion, cracks and pitting, all of which can lead to potentially devastating damage. The camera array creates high-fidelity 3D pipeline models that can be used to analyze the integrity of the pipe structure.

"With our UAVs and infrared cameras, it's very low-cost and fast. In minutes, we're getting very close to the same outcomes as the professional with a hammer can get in hours or days," Shen said. "We know, within inches, exactly where the delaminations are and their sizes."

The team has applied for multiple provisional patents on their technology for pipeline inspections and is considering commercialization opportunities for the rover.

Shen said the research is pioneering new directions in this field.

"In the past, when people talk about using infrared to detect those concrete delaminations, they say it is not reliable. I think (our work) is changing people's minds."

# DEVELOPING ROBOTS WITH “VARIABLE STIFFNESS”

Nelson makes robots with mechanical properties that can be adjusted on the fly.



NELSON

For decades, robots have helped humans be more efficient in their work, doing precise and repetitive tasks such as welding, painting and assembly.

These machines were often large, metallic creatures that were isolated from their human co-workers.

With present and future workforce needs in mind, Carl Nelson, professor of mechanical and materials engineering, is developing robots with “variable stiffness” that can quickly be adapted both to work environments and to required interactions with people.

“I’m interested in making robots that have mechanical properties that can be adjusted on the fly,” Nelson said. “The overarching idea is that, depending on the types of interaction that the robot is having, you want to have the ability to adjust the properties of the robot to keep those interactions safe and to make them appropriate to the task.”

With funding from the College of Engineering for medical research purposes and from the NASA Nebraska Space Grant for research that focuses on improving work done on future space missions, Nelson sees these robots as filling a variety of different needs, including human-robot collaboration.

The funding from the college is meant for medical purposes, such as rehabilitation with robots assisting people in regaining physical coordination and motor function, Nelson said. The NASA funding, he said, is related to rovers and the capability to “encounter diverse terrains and data streams with a multimodal-mobility approach.”

“These are different types of robots with different physical demands, some more stationary and others mobile, but in both cases, they need these variable stiffness components to enhance and expand the functionality of the system,” Nelson said.

Relatively recent advances in technologies — computers, artificial intelligence (AI), and materials, among many — have changed the possibilities for the ways robots can be designed and deployed. Nelson said he’s excited about being part of that future, which could include robotics-focused curriculum.

“That’s where I would like to work, in that area of robotics,” Nelson said. “As we develop that, it eventually becomes a core technology. Then you can do new things with what looks like an old robot; it now has new capabilities or can be integrated in different environments more safely.”



# BRINGING TECHNOLOGY TO LIFE, LITERALLY

## Markvicka oversees Smart Materials and Robotics Lab.

Working on the farm as a youth served as a catalyst for Eric Markvicka's love of engineering. Whether it was fixing broken equipment or replacing something worn on his grandparent's farm, the experience influenced his desire to "be creative" and "work with what you have" while moving forward efficiently when integrating technology and everyday life.

It's a similar scenario for Markvicka today — trying to make more malleable technology for humans and the environment in which people live. An assistant professor in mechanical and materials engineering at UNL, Markvicka operates the Smart Materials and Robotics Laboratory and is striving to develop wearable material science technology that interacts with the human body. It's one of the reasons NUtech Ventures named him its Emerging Innovator of the Year in 2021 as he has helped develop the type of technology presumably imagined in science fiction:

- Octa-glove.** This octopus-inspired glove helps divers grip objects underwater. Together, with research led by Virginia Tech's Michael Bartlett, Markvicka provided LiDAR (micro-light detection and ranging) optical proximity sensors to the glove, which serve as a detection system for the glove and mimics the nervous and muscular systems of an octopus.
- Electronic nose.** The "Wireless, Battery Free Wearable Electronic Nose" is research led by Markvicka that includes Dr. Stephen Rennard, professor of pulmonary research at the University of Nebraska Medical Center, and Jenna Yentes, Ph.D., associate professor of health and kinesiology at Texas A&M. The size of a coin, the electronic nose won the 2022 DMD 5-Minute Pitch competition at the Design of Medical Devices Conference. It's a sensing device that's used to detect and identify volatile organic compounds (VOCs) excreted through human skin or exhaled breath. It can be placed on the skin, adhered to clothing or a mask, and serve as a useful marker for disease as its sensor identifies chemical patterns or breath print signatures. One application for its use is the continuous monitoring and identifying of airborne chemical vapors to prevent the spread of environmental and chemical weapons. The research is currently being funded through the independent research and development program by the National Strategic Research Institute at UNL.

"I was always interested in working with my hands, even as a small child," stated Markvicka, Ph.D., in a NSRI Nebraska article last year. "On the farm, something is always breaking down. You learn fast that you must be creative and work with the equipment and parts you have, not be frustrated by it, as you rarely have time to wait for a replacement to arrive."

Additionally, Markvicka, a Ravenna, Nebraska native who earned bachelor's and master's degrees in mechanical engineering from UNL and a master's and Ph.D. in robotics from Carnegie Mellon University, is doing cutting-edge research at the Smart Materials and Robotics Lab. The lab continues to engineer new systems composed of distinctively soft materials with computer technology, like autonomously electrically self-healing soft electronics; ElectroDermis: Untethered electronic bandages; and autonomously electrically self-healing soft robotics.



# INNOVATIVE AUTOMATION

## Software engineering alum works to automate agricultural machinery

There's a robust future for agricultural robotics, growing from an estimated \$5 billion market three years ago to more than \$20 billion by 2025 as innovations in farming technology have made the industry safer and more efficient.

"The goal is to improve safety, increase accuracy and decrease costs," said Jacob Hansen, IT director for Aulick Industries and a 2021 graduate with a degree in software engineering from UNL. "It's not too far into the future where machinery in the fields, or most equipment used by farmers and ranchers, is fully mobile or autonomous."

Hansen, a Gering, Nebraska native, served an internship for Aulick, a Scottsbluff, Nebraska-based manufacturer of agricultural machinery, and now in his full-time position continues to further research and development projects for the company. The chance to integrate software technology into improving repetitive tasks found in agriculture is where he and Vinc Aulick, president of Aulick Industries, initially found common ground.

"Everything I've been doing has been related to research and development the last four years," Hansen described his day-to-day job at Aulick. "I'm fortunate where I got into a job that I get to dive into everything from GPS and perception sensors to embedded systems. I never do the same thing and that's exciting to me."

For example, Hansen and Aulick are developing autonomous agricultural machinery, something Hansen has been working on since his days as an intern. Both men know the safety ramifications and cost effectiveness of equipment that can operate robotically or autonomously are worth the time and effort. Aulick Industries has the equipment and facilities to manufacture equipment from the ground up, including the ability to design, fabricate, assemble and field test equipment in real world applications locally. Vinc Aulick said, "Jacob creates the software necessary to control all components of the

autonomous vehicle as well as GPS guided movement with robust safety and perception systems."

"There are so many applications within agriculture to pursue with this technology," Hansen said. "Anything that relies on similar, repetitive tasks involving equipment is something that could be automated with the technology we're developing."

A roadblock to integrating better technology into agriculture is addressing workforce and talent issues with robotics and automation. According to Hansen, it's difficult to find robotics engineers in the Midwest. Through his experience, many engineers who have this type of experience have migrated to places like California, Texas and Pennsylvania where there are more plentiful job opportunities. He's hoping that will change with Nebraska's Heartland Robotics Cluster, a coalition of Nebraska entities led by the Invest Nebraska Corporation and includes the UNL College of Engineering. Heartland Robotics Cluster is on the receiving end of a \$25 million federal grant to advance the state's economic output through the use of automation in agriculture and manufacturing.

"There are so many ways to improve safety and efficiency with robotics and automation in agriculture," added Hansen, whose office is located on Nebraska Innovation Campus in Lincoln. "A driver assistance system that we're currently working on will improve delivery of feed to cattle, decrease waste and cost as well as increase productivity."

For the time and investment they've already made in autonomous agricultural equipment, Hansen is pleased but knows there's a long ways to go.

"We've definitely made progress from where we started," he admitted. "Right now, I'd say our level of production for an assisted driver system is at a 2+ level, but we're currently testing and targeting a completely driverless system."

**DRONE IMAGE OF AN AUTONOMOUS VEHICLE PROJECT AT FALL RUN FEEDERS IN SCOTTSBLUFF - A FEED LOT WHERE AULICK INDUSTRIES IS TESTING AUTOMATION IN THE AGRICULTURAL INDUSTRY.**

# BEAM SIGNING

## UNL beam signing ceremony

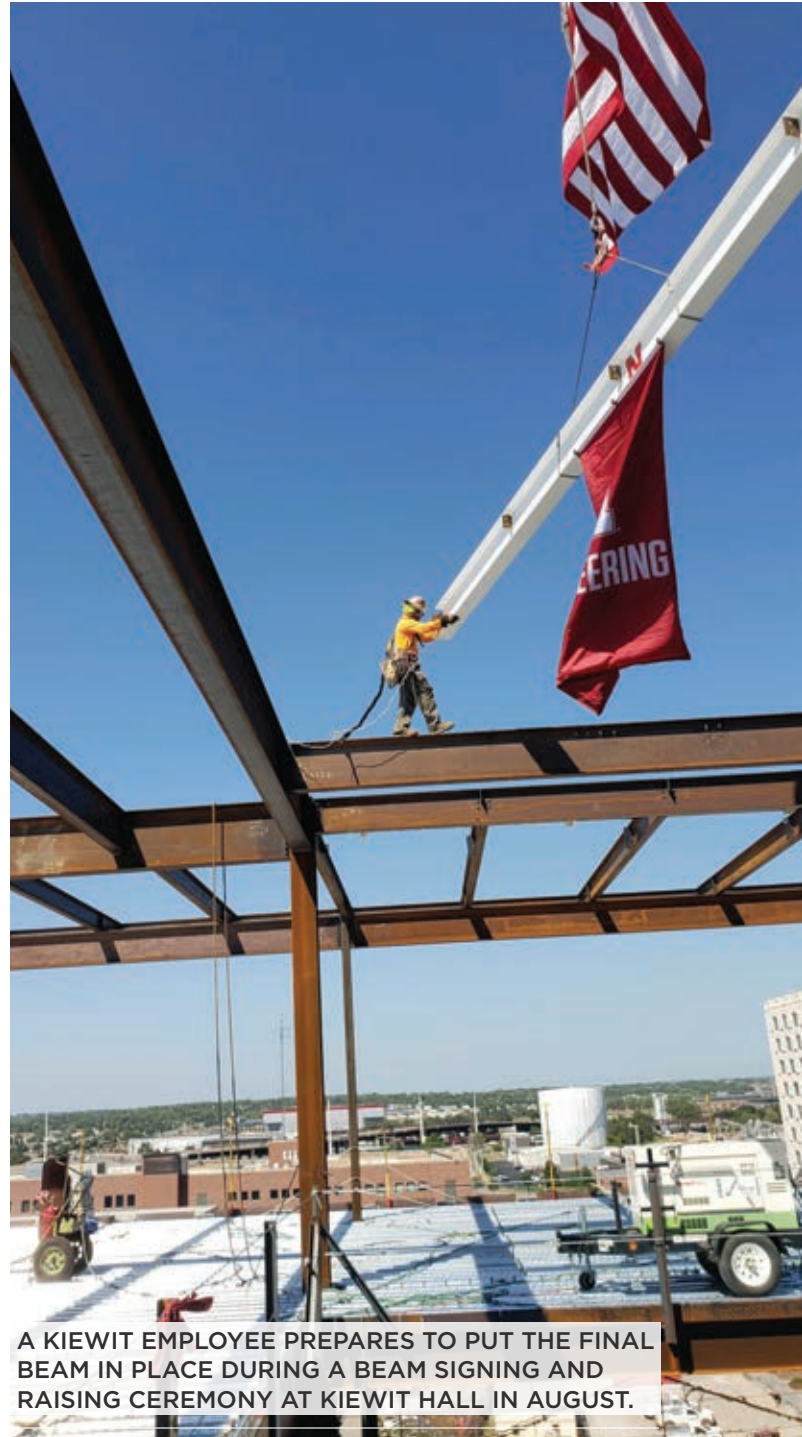
The campus community was beaming in August when the College of Engineering celebrated a Kiewit Hall milestone with a beam signing ceremony on the corner of 17th and Vine Street.

“Kiewit Hall will grant every engineering student the ability to learn as much as possible, to achieve their full potential, and to grow into a top-notch engineer,” stated Gracie Kerr, a sophomore civil engineering major from Omaha and one of the inaugural cohort of 10 Kiewit Scholars from 2021. “By ensuring that all Nebraska Engineering graduates leave prepared to make a difference, it is inevitable that the world will be changed for the better.”

In addition to recognizing the facility’s impending impact on the student community during the ceremony, special guests were acknowledged for their impact on Kiewit Hall’s construction, including architects for the project: Clark Enersen Partners and Ballinger; and key benefactors and donors the Abel Family, Robert and Joell Brightfelt, Hausmann Construction, Rick and Carol McNeel, Dan and Angie Muhleisen, Olsson, Union Pacific Foundation and Don Voelte and Nancy Keegan.

### Did you know?

- Kiewit Hall is part of an overall \$190 million expansion and facilities transformation for the College of Engineering on City Campus.
- Kiewit Hall will feature new learning and workspaces, capstone design and student organization project spaces, and a new home for the Lincoln-based construction programs.
- When completed, Kiewit Hall will be a 182,080 square foot building.
- Scheduled opening is January 2024.



**A KIEWIT EMPLOYEE PREPARES TO PUT THE FINAL BEAM IN PLACE DURING A BEAM SIGNING AND RAISING CEREMONY AT KIEWIT HALL IN AUGUST.**

# ALUMNI FEATURES

## Husker alum lights up his community with engineering expertise, volunteerism

For Maurice Kimsey II, when considering a career in engineering, it was literally a light going off.

"I became interested in electrical engineering from a class I took in seventh grade at King Science Center where I had to wire up a circuit board to get a light to turn on," said Kimsey, who was honored as a distinguished alum at the 2022 Multicultural Homecoming Social during UNL's Homecoming Week festivities. "It sounds cheesy, but a light went off in my head and I became curious about how electricity works."



KIMSEY

“I just want to ensure that I am doing my part to help our community grow and prosper.”

— Maurice Kimsey II, alumnus

Kimsey went home that night and talked about the project with his parents. They encouraged him to pursue his fascination with the distribution of power, which works out well in his job at OPPD as a distribution planning engineer.

"My parents said, 'that is an awesome job to go for,' but they preferred that I work with my mind and not with my back like they did so they convinced me to go to school for electrical engineering," he added.

Born and raised in Omaha, Kimsey graduated from Central High School in 2006 and earned his bachelor's degree in electrical engineering from the College of Engineering in 2012. He was one of eight alumni recognized during the Homecoming Multicultural Social Program sponsored by the Chancellor's Commission on the Status of People of Color.

While his expertise as a distribution planning engineer has been invaluable to OPPD for the past seven years, his significance to the Omaha community is immeasurable. He uses his platform as an engineer and what opportunities are available at OPPD to volunteer with organizations such as Partnership 4 Kids and 100 Black Men of Omaha, Inc.

"I got involved in volunteering because I see opportunities that are available to students in our community," explained Kimsey, who with his fiancé, Sujei Pichardo, share a daughter, Nailah Pichardo. "I want to ensure that we are educating them on the strategy and tools needed to be successful."

An intern at OPPD for five years while attending UNL, Kimsey also speaks at schools in the Omaha community about engineering and the opportunities that are available to the students.

"I have seen many people growing up in North Omaha who are smart and good people but miss out on opportunities that would help them be successful," added Kimsey, who enjoys lifting weights, playing video games, and watching movies in his man cave outside of working at OPPD and volunteering. "I just want to ensure that I am doing my part to help our community grow and prosper."

## Mumgaard's passion for clean energy lands him on prestigious Boston Globe list

Combating climate change by powering Earth with clean energy is an extremely tough task but it's what Bob Mumgaard is fighting for in his mission to commercialize fusion power. Mumgaard, a 2008 graduate of the College of Engineering, was named to the Boston Globe's Top 50 list of Tech Power Players in Massachusetts as his company, Commonwealth Fusion Systems (CFS), is poised to be a game-changer when it comes to supplying the world with clean energy.

As cofounder and CEO of CFS, Mumgaard is part of a list of the most influential — and interesting — people in Massachusetts technology as ranked by the Boston Globe's business journalists and external advisory committee. He's passionate about a future powered by clean, unlimited fusion energy.

"The world needs clean energy," said Mumgaard, who graduated with both a B.S. in mechanical engineering and in engineering physics from UNL in 2008 and has a Ph.D. in applied plasma physics and an M.S. in nuclear engineering from MIT. "For far too long, the world has relied on fossil fuels and other resources contributing to environmental issues. Through innovation, technology, and science, we can break that."

Mumgaard founded CFS in 2018 as a fusion energy startup company out of MIT. There, Mumgaard began working with some of the best physicists and engineers in the world and, with early funding, they decided to start developing a commercial fusion energy system based on their experience and research in fusion programs. This was in 2015 and, three years later, CFS was born out of a vision he and his co-founders saw of the future.

"When I was at Nebraska, I thought I'd graduate, go for my Ph.D., be a professor and do research," Mumgaard said. "Even when I was at MIT, I still thought I'd do that but then I realized I could have a bigger impact on the world if I did it with our own company using fusion and other technologies."

In addition to recognizing each honoree's technology and business influence, the Globe's Tech Power Players 50 list acknowledged tech-specific contributions and innovations during the pandemic as well as their efforts to promote diversity, equity and inclusion.



MUMGAARD

### Mumgaard's Career Milestones

- **2016:** Became postdoctoral fellow at MIT
- **2019:** In collaboration with National Labs, Commonwealth Fusion Systems (CFS) won U.S. Department of Energy Award
- **2021:** Raised \$1.8 billion in venture funding for CFS

“ The world needs clean energy. For far too long, the world has relied on fossil fuels and other resources contributing to environmental issues. Through innovation, technology, and science, we can break that. ”

— Bob Mumgaard, alumnus



FLAMME

## Love of math, solving problems equals unique engineering career for Alex Flamme

Growing up, Alex (Sukup) Flamme loved math and solving problems. She just didn't see herself doing it in a career or at college for that matter. Luckily, though, her love of math added up to her earning a mechanical engineering degree.

"I always liked math, but I didn't want to do math for a degree in college, so I chose engineering," said the 2020 graduate who's now using her skills as an engineer at Lincoln-based Huffman Engineering, Inc., which was named 2022 System Integrator of the Year by Control Engineering and Plant Engineering Magazine.

The award recognizes a contract engineering firm that can design and implement computerized control systems for industrial machinery, manufacturing lines or additional automated facilities. Flamme says the honor is something Huffman Engineering is very proud of because it's a category that recognizes worldwide companies.

"It's a really big honor," said Flamme, a Norfolk, Nebraska native. "It takes into account customer testimonials so to have that recognition from customers and people you're doing business for is something to be proud of."

While Flamme's journey to engineering began with a fondness for math, she also loves to read and write. Combining all of those disciplines into a career made her consider systems engineering and especially working with others to solve problems.

"I think I'm good at seeing the big picture and overcoming obstacles," added Flamme, who began as an intern at Huffman prior to becoming a full-time engineer.



ALEX FLAMME OF HUFFMAN ENGINEERING IN LINCOLN.

“ I see amazing things in engineering every day and developing ideas and working towards solutions for Huffman is something I hope to be doing for a long time. ”

— Alex Flamme, alumna

## THE BIG PICTURE

One of the obstacles Flamme overcame was graduating from UNL during a time when the world turned upside down. As students and faculty pivoted from in-person classes to online learning in March 2020, Flamme was finishing up her senior year and wondering what her future looked like. She had just begun her Huffman internship in January 2020 and was looking forward to the final months of college when the pandemic interrupted everything from classes and labs to a scheduled vacation in the Caribbean.

“Nothing was routine anymore,” she admitted. “Everything seemed scattered and uncertain. Not knowing what was going to happen and being in college made it even more difficult. But I think, more than anything, it taught a lot of students to keep fighting through it and get done with (school) because that’s the only thing we could do.”

Another thing she was able to do was work. Even though the Bahamian vacation was canceled it led to her pivoting once more to begin as a full-time engineer at Huffman.

“I was supposed to go to the Bahamas after graduation,” she recalled. “Obviously the trip was canceled due to COVID, but it all worked out because I was able to transition into my role at Huffman that same week. Seeing the big picture, I was fortunate because some of my peers had their jobs canceled due to COVID.”

## MOVING FORWARD

Now, three years later, Flamme is happily married to her husband, Evan, who has a job with Lancaster County. They met when he was a mechanical engineering major; they were both in the same CAD class. In fact, she sat right next to him and only spoke to him once the entire semester. It was social media who played the part of Cupid in finally bringing the couple together.

“I friended him on Facebook,” she said with a laugh. “I think that gave him the confidence to ask me out.”

As she grows in her career, Flamme wants to use her experiences as a showcase to other women seeking careers in engineering as she also represents Huffman Engineering at college STEM career fairs. As a 24-year-old, she still relates to college-age women looking for their first job in engineering.

“It’s definitely more fun being on this side of it,” said Flamme, who was at her alma mater for the Fall 2022 UNL Career Fair in the Nebraska Union. “It was more stressful as a student looking for a job and trying to map out a career.”

Her advice to students looking for opportunities: “Are you reaching out to companies just because you know you need a job or are you genuinely interested in the work they do? It makes a big difference,” she added.

She’s also in a unique position working on the automation of production lines in manufacturing facilities, so much so that she’s yet to work onsite with another woman who does what she does. In fact, she notes that being a woman in engineering offers its share of challenges, particularly when traveling to other parts of the world.

“To me, it’s about looking to others and finding confidence to stay in the game,” explained Flamme, who graduated from Norfolk High School. “When I was at a conference, in a room of more than 60 engineers, there were three women. At the same conference, I attended a Women in Manufacturing luncheon where I was seated with marketing professionals or women who are in roles other than STEM. Seeing yourself being able to do it is significant.”

It’s why Flamme feels a responsibility when meeting women at career fairs, telling her story and making it known that they’re the future of engineering.

“When I was a student and told someone I was majoring in mechanical engineering, many responses were ‘that’s a really hard major,’ while my male classmates usually got the response ‘good for you.’ That’s really hard because it sticks with you,” she admitted. “It should be expected, not unusual, that we’re pursuing the same opportunities in a male-driven career.”

Flamme is very excited about her career with Huffman and the promising future the company holds.

“Huffman is growing, and I love what I’m doing,” she said. “I see amazing things in engineering every day and developing ideas and working towards solutions for Huffman is something I hope to be doing for a long time.”

# HIGHLIGHTS AND AWARDS

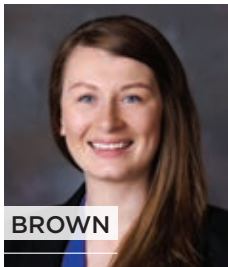
## Biological Systems Engineering



■ The rows of no-till plots on the University of Nebraska Rogers Memorial Farm stand as a testament to the practicality of no-till farming — 42 years and counting. The impact of these plots and the farm’s other research was celebrated Sept. 22, when the department of Biological Systems Engineering hosted an event to

honor 75 years of Rogers Memorial Farm. The anniversary provided a retrospective of the farm and a glimpse at future agricultural research possibilities.

## Chemical and Biomolecular Engineering



■ Brandi Brown, a postdoctoral researcher at the University of Nebraska–Lincoln Industrial Agricultural Products Center, has received a USDA Postdoctoral Fellowship. This prestigious fellowship is part of USDA’s Agricultural and Food Research Initiative to develop the next generation of research, education

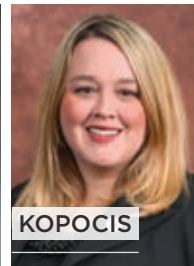
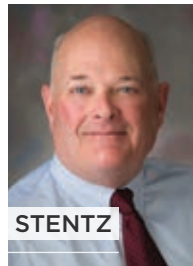
and extension professionals in the food and agricultural sectors. The fellowship includes a two-year, \$225,000 grant for a proposal Brown submitted while earning her Ph.D. in Biological Engineering at UNL, working with Rajib Saha, assistant professor of chemical and biomolecular engineering.

## Civil and Environmental Engineering



■ Inspired by the ability of the human body to heal itself, Congrui “Grace” Jin (assistant professor) has been awarded a Defense Advanced Research Projects Agency Young Faculty Award to support research using microorganisms to develop a concrete that can heal its own cracks.

## The Durham School of Architectural Engineering and Construction



■ Terry Stentz (associate professor), Kelli Kopocis (assistant professor of practice) and Kyungki Kim (assistant professor) were awarded a \$154,568 grant from the Department of Labor-OSHA for a project entitled “Susan Harwood Training Grant Program - Personal Protective Equipment.”

## Electrical and Computer Engineering

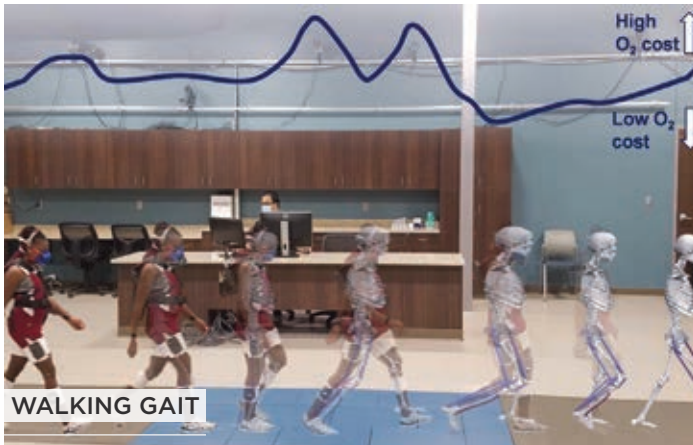


■ Benjamin Riggan (assistant professor) is part of WatchID, a team of researchers from across the country participating in a competitive federal government research program to develop software systems capable of performing whole-body biometric identification from long distances and at elevated pitch

angles. The Intelligence Advanced Research Projects Activity (IARPA) website noted that the Biometric Recognition and Identification at Altitude and Range (BRIAR) program is vital because many intelligence agencies require the ability to recognize individuals under challenging scenarios — such as at long range (300+ meters), through atmospheric turbulence, and from watchtowers or unmanned aerial vehicles (drones). IARPA projects are administered by the Office of the Director of National Intelligence.



## Mechanical and Materials Engineering



WALKING GAIT

■ Scientists who have studied the metabolic cost of different phases of the walking gait cycle have encountered difficulty in collecting data – partly due to physical demands on the test subjects and because measurements aren't collected quickly enough to be of great value. A collaboration between researchers from the University of Nebraska–Lincoln College of Engineering and the University of Nebraska at Omaha College of Education, Health, and Human Sciences is using cutting-edge digital technologies — such as artificial intelligence and machine learning — to improve on the current collection methods and to develop algorithms to further research.

## School of Computing



FALKINBURG



HUSKER STEM

■ A team of School of Computing Senior Design students is expanding on a previous virtual reality project for the College of Engineering.

The Husker STEM VR project is a virtual reality app that will be used in the college as an outreach and recruitment tool. The app would allow prospective students to explore majors and research as well as engineering principles and disciplines. School of Computing lecturer and project sponsor Jeff Falkinburg tasked his first Senior Design team with developing a virtual tour of Memorial Stadium to enable prospective students to explore computing majors and determine which was the best fit for them. This year, he assembled a new team to build on last year's project.



## College is ASEE national leader for Diversity Recognition Program

The College of Engineering is among the first group of institutions across the U.S. to achieve Silver Award status within the American Society for Engineering Education (ASEE) Diversity Recognition Program. Only three engineering colleges have achieved Silver Award status, which recognizes sustained and measurable increases in diversity, inclusion, and degree attainment outcomes by students from underrepresented racial and ethnic groups.

“The College of Engineering is committed to providing an inclusive and diverse community as we work to fulfill our mission to meet the workforce demands and drive economic development in the state of Nebraska,” said Lance C. Pérez, dean and Omar H. Heins Professor of Electrical and Computer Engineering.

In 2019, the College of Engineering was in the first cohort of colleges to earn bronze-level recognition through the ADRP. Since earning this honor, the college has made quick progress toward its goals of increasing diversity and enhancing inclusion among faculty and the student body, including:

- Increases in the percentages of women faculty, women undergraduates, and undergraduates from racial and ethnic backgrounds who are underrepresented in science and engineering (UREG).
- Improved diversity in leadership positions, with women leading three of the college's six academic units.
- Student recruitment initiatives, including the Peter Kiewit Foundation Engineering Academy and the Kiewit Scholars Program, whose combined scholars are 70 percent women and 44 percent UREG.

# MwRSF OPEN HOUSE

## Research showcase included full-scale crash test of a barrier connector.

The Midwest Roadside Safety Facility (MwRSF) hosted a research showcase open house on Sept. 9, 2022, including a full-scale crash test of a barrier connector at the Outdoor Proving Grounds on the west side of the Lincoln Municipal Airport.

The event began with a reception in the Prem S. Paul Research Center at Whittier School in which more than 100 visitors learned about the ongoing research and equipment used at MwRSF, discussed collaborative research and employment opportunities, and met with faculty and staff.

It concluded with the crash test of a pickup truck into a MwRSF-developed connector that links two different types of barriers. The truck's front, driver-side wheel contacted the connector at about 60 miles per hour. The truck sustained significant damage — its front, driver-side wheel was torn loose after it snagged on the barrier connector.

Still, only a minute after the crash test was over, researchers were satisfied with the performance of the connector. Bob Bielenberg, research engineer at MwRSF, said the device seemed to have performed well on the most-important criteria – providing a safer outcome to people who might be involved in such a collision.

“Our first goal is to protect the people who are traveling on the roadways when these events happen,” said Bielenberg. “I think the test went well.”

After a test like this, MwRSF researchers typically take all the video and sensor data they gathered and begin analyzing to determine if the connection performed up to expectations. This test, like the test of each individual system, has its own set of unique criteria that are evaluated.

“The first thing you have to do when you connect two barriers is make sure the stiffness between them is similar so the vehicle redirects smoothly,” Bielenberg said.

“What we’re looking for here is when the vehicle goes through that joint between the two systems, does it do it smoothly and does it safely redirect it without grabbing the vehicle and decelerating it too fast? We want to see how much that grabbed on and if we got deformations to the occupant compartments that could cause injury to somebody in the vehicle.”



ATTENDEES SAW FIRSTHAND THE RESEARCH BEING DONE AT MWRSF DURING LAST FALL'S OPEN HOUSE.

**TOP 10  
PROGRAM**

# **ONLINE MEM NETS U.S. NEWS TOP 10 RANKING**

## **MEM among the top U.S. programs**

The Master of Engineering Management program in the College of Engineering garnered a No. 9 ranking in the 2023 U.S. News & World Report's rankings of Best Online Master's in Engineering Programs, and No. 6 in the same category for veterans.

It's an eight-place rise for the MEM, which ranked No. 17 in the 2022 rankings.

One of nine programs internationally certified by the American Society for Engineering Management, the **Master of Engineering Management** is a 30-credit-hour program designed for working professionals in engineering, technology and science industries.

- ▶ For more information or to register for an informational session with the MEM director, go to [engineering.unl.edu/mem/](https://engineering.unl.edu/mem/).



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ENGINEERING AT NEBRASKA

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