

CYCLONE ENGINEERING



IOWA STATE UNIVERSITY
College of Engineering

SPRING 2022

New hub of student
innovation

Honing in on hackers

Sweet sound of
engineering

New hot spot to innovate

Cyclone Engineers have a new hub for creativity and collaboration in Iowa State's Student Innovation Center. The center is home to student makerspaces and student organization build areas ranging from 3D printing to digital visualization to glass blowing.



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Iowa State
University's
historic
\$1.5 billion
campaign

\$257,152,443

raised to support the
College of Engineering



220 new scholarships for
Cyclone Engineering students



43 new named engineering
faculty positions



Nanovaccine Institute facilities (pictured)
Marston Hall renovation
Student Innovation Center (read more on next page)



STUDENT INNOVATION CENTER

The Student Innovation Center is a 140,000 square foot hub of innovation and collaboration on campus.

Collaboration spaces to build something new, together

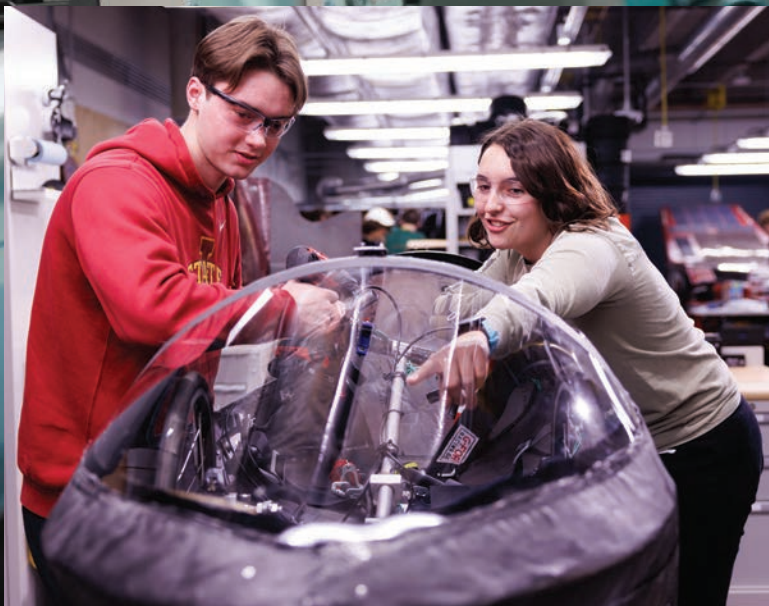
- Home to engineering design-build organizations, including the Robotics Club, PrISUm solar car team, Baja SAE and Cardinal Space Mining Club.
- Engineering capstone projects come to life in co-working suites.
- Learning-in-the-round classroom space and flexible gathering areas designed for discussion.

Fabrication facilities turn ideas into products

- Electronics, textiles and 3D printing workspaces
- Metal, woodworking, glass blowing, composite materials and finishing shops
- Digital media production and data, modeling and visualization studios



***Cyclone Engineering** students get hands-on experience in the Student Innovation Center, working on interdisciplinary design-build teams and pursuing projects in makerspaces.*



Innovation Programs

- **Innovation Fellows Corps** is a multidisciplinary innovation mindset, skill and experience training program open to undergraduate and graduate students. Fellows earn certificates through innovation activities ranging from seminars to launching their own “big challenge project.”
- **Innovators in Residence** are among industry’s most successful engineering and business leaders, offering students one-of-a-kind mentorship and coaching.
- **Flagship Friday** forums bring industry professionals’ personal stories of innovation and progress to campus and the community.
- **Innovation Circuit workshops**, led by recognized experts, develop specific innovation mindsets, skills and practices.
- **Innovation Challenges and Sprints** bring together teams of students, faculty collaborators and business innovators to propose solutions to specific industry problems.
- **Student Innovation Fund** invests in interdisciplinary student teams to provide hands-on experience in advancing early-stage innovations.
- **Professional Practice Forums** where faculty, alumni, staff and grad students present findings on the forefront of innovation education and practice.



“Iowa State offers the innovation programs, facilities and support I needed to engineer a totally new braking component – and launch a startup.”

- Tyler Heintz
senior in mechanical engineering

Engineering Entrepreneurs

- **400-level project-based courses** in entrepreneurial product engineering taught by proven engineering entrepreneurs
- **Undergraduate minor** in entrepreneurial studies
- **Graduate certificate** in entrepreneurship and innovation
- **Faculty Engineering Entrepreneurship Fellow** in each Cyclone Engineering department
- **Entrepreneurial Product Development Engineering** student organization

start something

College of Engineering

A portfolio of college-based academic offerings designed to cultivate and support students' entrepreneurial mindsets. Teaching and coaching students to work with customers and leverage new technology to engineer value-oriented marketplace solutions.



Scan Here!

Learn more about Cyclone Engineering entrepreneurs, intrapreneurs and change-makers at startsomething.engineering.iastate.edu



Writing the script for cyber security research and education

Doug Jacobson's leadership in cyber security research and education began before high-speed internet, smartphones and Google. It even predates the term "cyber security" itself.

Jacobson, Stanley Chair in Interdisciplinary Engineering, University Professor of electrical and computer engineering, and director of the Center for Cybersecurity Innovation and Outreach, was one of the few who saw "information assurance" threats looming in the early 1990s.

"When I would give talks early on, I spent most of the time explaining why anyone would even launch an attack, because at that time hackers weren't in it to make money – and

without that motivation, not many people believed cyber security would amount to much of a problem," said Jacobson.

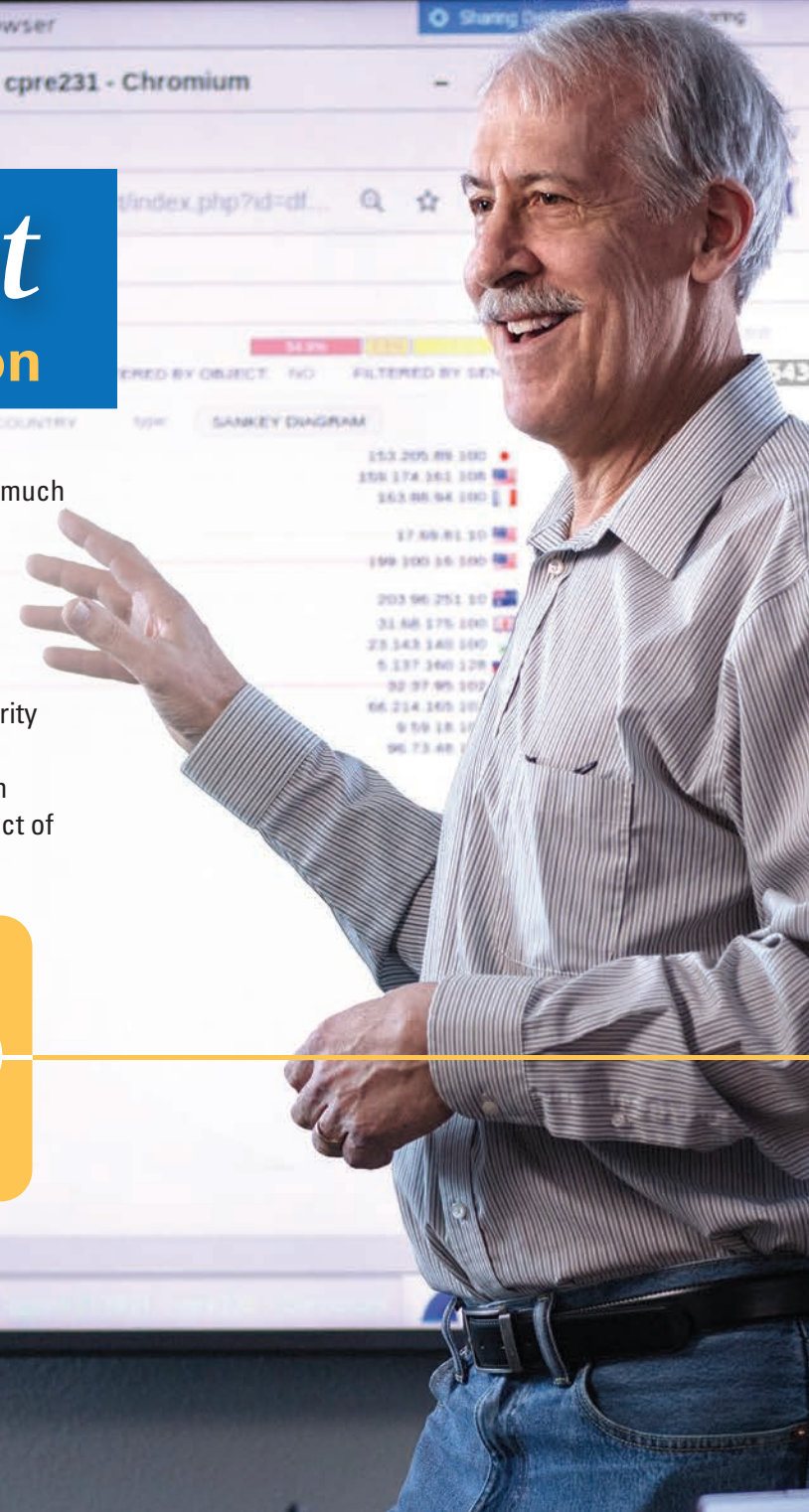
Estimates of global losses from cyber crimes now reach into the trillions of dollars per year.

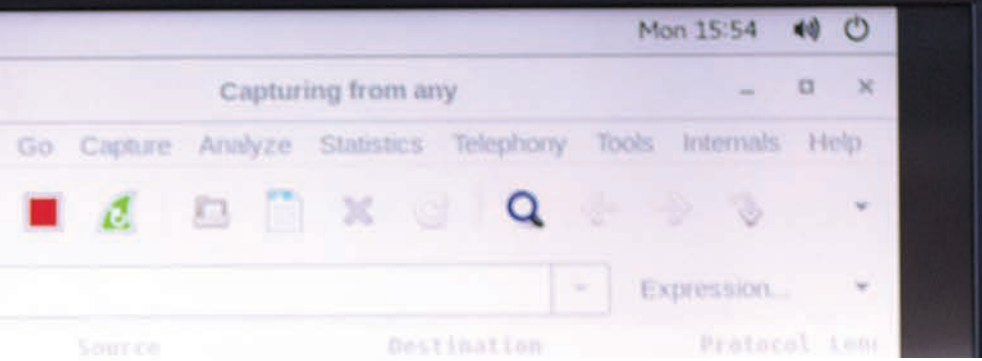
For more than 30 years, Iowa State has been a national leader in cyber security research, education and outreach – and Cyclone Engineers now have their eye on future challenges in securing every aspect of modern life.

**Long-standing
Cyber Security
Leader**

1994

**First external research
award to study cyber security**





Cyber Defense for Everyone

Iowa State has created cyber security literacy education for all users of technology, including the Iowa Cyber Hub that centralizes cyber security resources for lowans—and youth and public outreach materials used nationally.

“Technology can’t win the cyber security battle alone. Users must also play an active role in their own protection, so while it’s critical we develop new approaches and educate new cyber security professionals – we also will continue to offer cyber security education to everybody,” said Jacobson.

1996

Iowa State offers one of the nation’s first “information warfare” courses

2000

Iowa State establishes the Center for Cybersecurity Innovation and Outreach (then known as the Information Assurance Center)

Tomorrow’s Cyber Security Engineers

- ▶ **20 faculty** teaching and researching in cyber security
- ▶ **ISEAGE**, the Internet-Scale Event and Attack Generation Environment, offers unique virtual internet for students to test cyber defenses
- ▶ **A nine-state coalition**, led by Jacobson, trains a new workforce to protect the Midwest’s energy infrastructure from cyber attacks
- ▶ **More than 10,000** undergraduate, community college and high school students have participated in 75 hands-on, real-time Cyber Defense Competitions since 2005
- ▶ **Undergraduate major** in cyber security launches in **2019**

To the Tune of

A close-up photograph of a young woman in a maroon and yellow marching band uniform playing a trumpet. A smartphone is mounted on the trumpet's valves using a custom 3D-printed yellow clamp. The background is dark with some bokeh lights, suggesting an indoor arena or gymnasium.

Songs on screen

Marching band sheet music entered the digital age when Cyclone Engineering student **Jack Evans** designed and 3D printed instrument clamps so Iowa State marching band members can now read music and drill charts on their cell phones as they learn new shows.

Evans is a concurrent mechanical engineering and MBA student and member of the Cyclone Marching Band, made 250 clamps in a total of 1,200 machine hours in Iowa State 3D printing labs, and said his long-term goal is to continue innovating until the clamps are affordable and accessible to every marching band.

Ring the bells

Music from Iowa State's campanile fills campus, but the beautiful sounds of bells can reach much farther with a playable, portable carillon model created by Cyclone Engineering students, alongside students from design, music and business.

The unique hands-on design challenge has spanned project-based engineering courses over more than four years. Now the model can go on the road for concerts, outreach and music education.

Engineering

Sweet sound of sustainability

Cyclone Engineering undergraduates teamed up with music and theater majors to turn plastic wastes into durable plastic musical instruments.

“The project began with one simple problem: instruments, instrument parts, and instrument repair are very expensive due to their complex shape and select materials. Plastic waste is about as cheap as you can get in terms of material.

But quality and safety of instruments and parts can be greatly improved by employing the latest in materials science. As we began brainstorming different solutions and facets of this program, we quickly realized that we could perform near-endless innovation in the fields of materials processing, instrument design, and sustainability,” said **Ayman Karmi**, senior in materials science and engineering student project leader.

Shan Jiang, assistant professor of materials science and engineering, is the faculty advisor to the Recyclables Evolved from Offscouring Remade to Music project, which received Iowa State Student Innovation Fund and Iowa Space Grant support.

Music lights the way

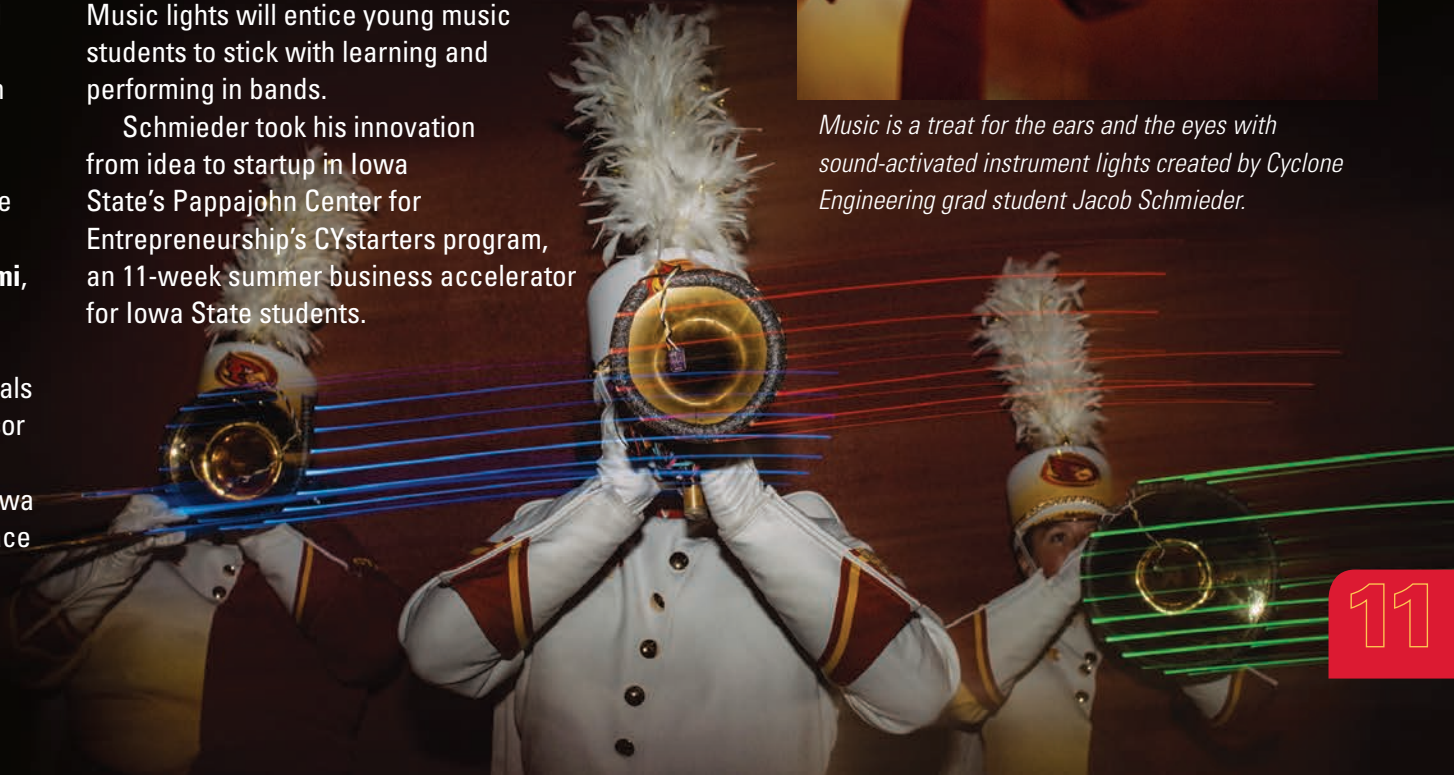
Jacob Schmieder, a graduate student in mechanical engineering, combined his engineering skills, talents as the drum major of the Iowa State University Cyclone Football “Varsity” Marching Band and entrepreneurial spirit to launch Varsity Music, a startup that makes sound-activated instrument lights.

The Varsity Music component is programmed so different musical notes played coordinate to different colors of light, creating a performance that looks as exciting as it sounds. And, Schmieder hopes, Varsity Music lights will entice young music students to stick with learning and performing in bands.

Schmieder took his innovation from idea to startup in Iowa State’s Pappajohn Center for Entrepreneurship’s CYstarters program, an 11-week summer business accelerator for Iowa State students.



Music is a treat for the ears and the eyes with sound-activated instrument lights created by Cyclone Engineering grad student Jacob Schmieder.



Complex connections in AMR

Adina Howe, associate professor of agricultural and biosystems engineering, leads a \$1 million project to study how manure management systems in livestock production affect the development of bacteria capable of resisting antibiotics.

The majority of antibiotics in use today are used in animal production, and antibiotic-resistant bacteria can wind up in manure before making their way into the environment, such as when manure is applied to fields as fertilizer. Howe's research team aims to figure out what resistant genes are proliferating in bacteria and how widely those bacteria spread and persist in soil.

To answer these questions, the research team will receive manure samples from pig farms in Iowa on which to conduct laboratory experiments. Some of the manure used in the research will come from pigs that have been exposed to antibiotics, while some samples will come from pigs that never received antibiotics. The researchers will then attempt to connect the dots between antibiotic-resistant bacteria they find in the manure and the specific antibiotics applied to the pigs involved in the experiments.

The researchers also will examine the feasibility of various methods to stop the spread of resistant bacteria, such as decomposition with composting – and anaerobic digestion, in which manure is sealed in an oxygen-free tank and broken down into biogas and biofertilizer.

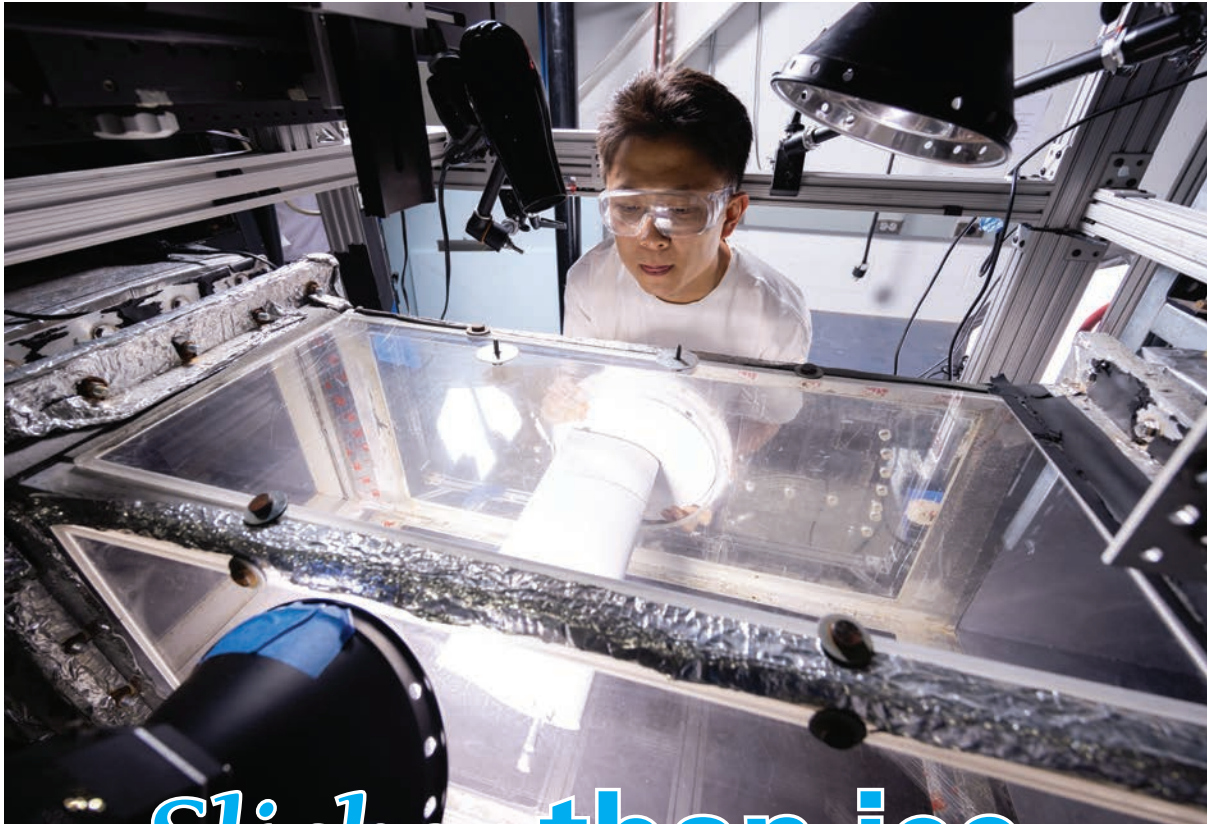
Collaborators include **Michelle Soupir** and **Daniel Andersen**, both Iowa State associate professors of agricultural and biosystems engineering, and researchers from the University at Buffalo. The work is supported by the USDA-National Institute of Food and Agriculture.

“We’re all connected far more closely than we previously recognized – humans, the environment and agriculture.”

– Adina Howe



Cyclone Engineers are studying the links between microbes, plants and soil. Grow lights simulate the natural growth conditions for crop plants.



Slicker than ice

Every winter, icing on wind turbines causes millions of dollars in power and maintenance losses. So, **Hui Hu**, the Martin C. Jischke Professor in Aerospace Engineering, is developing a new class of icing protection systems to ensure safer and more efficient operation of wind turbines in cold climates.



Hu's team will integrate Dielectric-Barrier-Discharge plasma actuation to modify airflow on turbine blade edges with an ice-phobic coating to reduce icing over the whole blade surface. Then they'll test prototypes under various realistic icing conditions in Hu's one-of-a-kind icing research tunnel and do field testing in frigid Midwestern weather to ensure the technology can quickly be commercialized.

Two New Research Centers

Cyclone Engineers lead two new, interdisciplinary research centers at Iowa State:

The **Center for Wireless, Communities and Innovation** will drive research, education and innovation in advanced broadband technologies for connected rural regions. WiCI will be led by **Hongwei Zhang** (top right), professor of electrical and computer engineering, who also leads Iowa State's \$16 million ARA Wireless Living Lab project.



The **Translational AI Research and Education Center** brings together Iowa State's artificial intelligence and machine learning experts with researchers in agriculture, manufacturing, health care, transportation, energy and beyond to use AI to advance discovery. The center is led by **Soumik Sarkar** (bottom right), Walter W. Wilson Faculty Fellow in Engineering and associate professor of mechanical engineering.



Amy Kaleita named chair of agricultural and biosystems engineering

Amy Kaleita has been named chair of Iowa State's Department of Agricultural and Biosystems Engineering.

Kaleita's research focuses on information technology for precision conservation including remote sensing, crop and hydrologic modeling, precision farming, and advanced analytical methods for understanding the influence of spatiotemporally variable soil and hydrologic properties.

She has taught courses in soil and water conservation management and engineering and analytical techniques for data and modeling – and has received several awards for teaching excellence. She has also served on the ABE department's curriculum committee, been active with the accreditation process, and plays a role in the college's Honors Program.

Kaleita is a fellow of the American Society of Agricultural and Biological Engineers and has received the National Academy of Engineering's Gilbreth Award for Young Engineers, among others.

She received a doctorate degree in agricultural engineering and a master's degree in civil engineering from the University of Illinois at Urbana-Champaign, and a bachelor's in agricultural engineering from The Pennsylvania State University.

Kaleita was named the ABE interim department chair in March 2021 when the previous chair, **Steve Mickelson**, was appointed special advisor for student information systems in the Office of the Senior Vice President and Provost. ABE programs are jointly administered by Iowa State's College of Engineering and College of Agriculture and Life Sciences.



U.S. News and World Report rankings

#2 undergraduate program in agriculture and biosystems engineering

#2 graduate program in agriculture and biosystems engineering

New agricultural and biosystems engineering facilities

Kent Corporation Feed Mill and Grain Science Complex

Off-Highway Vehicle Chassis Dynamometer

Soil-Machine Dynamics Laboratory

Fellowship propels aerospace career

Hanna Stec, junior in aerospace engineering, is one of only 51 selected from more than 1,000 applications as a 2022 Brooke Owens Fellow, a paid internship and executive mentorship program for women and gender-minority students in aerospace engineering.

Stec will intern at Iridium, working on a team that monitors 66 active satellites. Since her first year at Iowa State, she has been an undergraduate research assistant in the lab of **Kristin-Yvonne Rozier**, Black and Veatch Building a World of Difference Faculty Fellow in Engineering and associate professor of aerospace engineering.

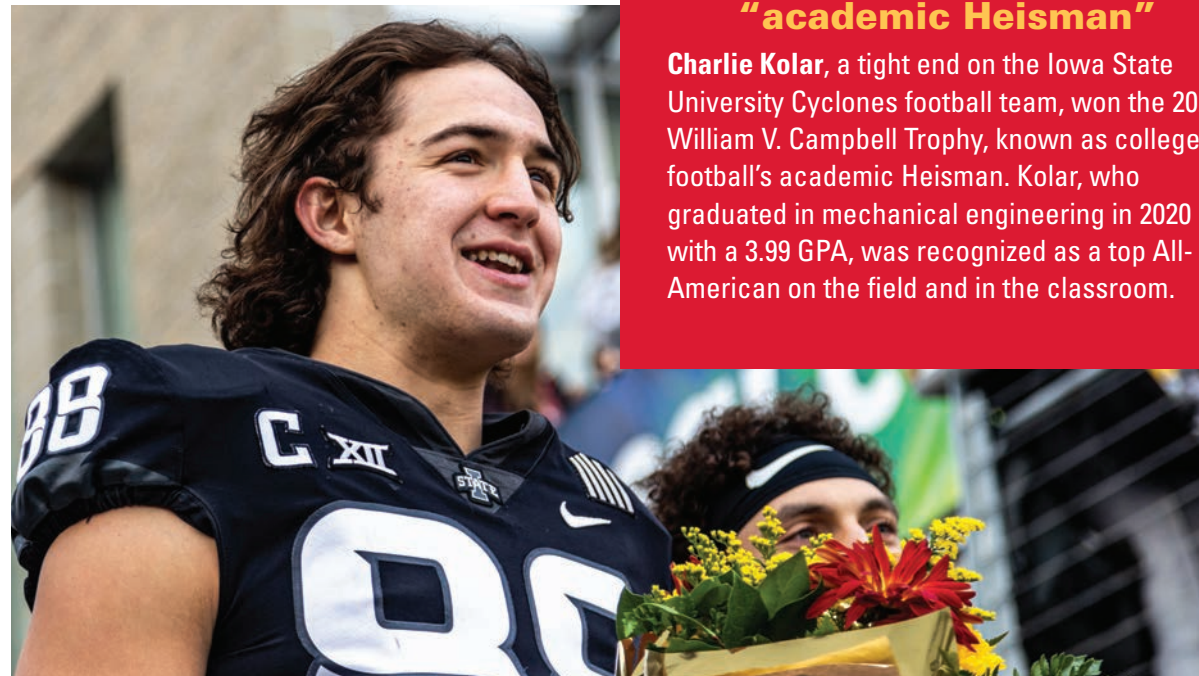


New CAREER Award: Batteryless sensors

Henry Duwe, Harpole-Pentair assistant professor of electrical and computer engineering, will develop software and hardware techniques to distribute intelligent computations across a network of batteryless, intermittent sensor nodes. Instead of relying on sensor nodes that have ready access to wired power or a battery, his project will investigate approaches where nodes operate using power supplied solely by energy harvested from their operating environment and, thus, spend a significant amount of time without sufficient power to operate.

Cyclone Engineer wins "academic Heisman"

Charlie Kolar, a tight end on the Iowa State University Cyclones football team, won the 2021 William V. Campbell Trophy, known as college football's academic Heisman. Kolar, who graduated in mechanical engineering in 2020 with a 3.99 GPA, was recognized as a top All-American on the field and in the classroom.



MAKE TO INNOVATE

10 Year Anniversary!

Iowa State's Make to Innovate program is celebrating 10 years of hands-on, real-world engineering learning. Over the last decade, more than 1,000 M:2:1 students have partnered with industry leaders to take on aerospace engineering challenges in 4,000 square feet of state-of-the-art workspace.

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