CU ENGINEERING

2022

A Natural Fit

See how we're meeting big challenges in sustainability

DRIVING FORCE

Taking on transportation, from electrified roadways to better fuels

HOME WORK

Students ready to defend CU's Solar Decathlon title

University of Colorado **Boulder**

What's your **giving story?**

Suzi Jewett (MMechEngr'00) has been a loyal donor to the BOLD Center for 17 years.

"When I was at CU, I was heavily involved in the Women in Engineering Program. It was a community that supported me and helped me to grow and maintain my motivation to pursue engineering. My parents had instilled in me a heart for giving, so after I graduated and began earning a salary, it was important to me to begin giving back.

I enjoy seeing the growth of CU and how the college is changing its approach to learning and development for engineering students. I recognize the importance of a smaller community for students and believe the BOLD Center provides community, support, guidance and opportunities, allowing students to have higher potential for a meaningful career. I want to be able to bless others how I have been blessed."

Jewett served as a panelist for the college's inaugural Women in Engineering Panel & Networking Event.

To learn more about giving opportunities, visit colorado.edu/engineering/giving

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FEATURES

ALUMNI PROFILES

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& Applied Science

CU ENGINEERING MAGAZINE ONLINE

colorado.edu/engineering/cue2022

MESSAGE FROM **THE DEAN**

@KeithMolenaar

Dear CU Engineering community,

When I began my term as acting dean of the College of Engineering and Applied Science in January 2020, my top priority was maintaining consistency with the goals, vision and culture that our community developed in partnership with former Dean Bobby Braun.

As we prepare to welcome a permanent dean, I am proud to say that we have been successful in many of those goals. In both 2020 and 2021, we celebrated record-breaking research funding across the college. In 2021, we were the No. 1 aerospace engineering program in the U.S. in research expenditures. We have made strides in diversity, equity and inclusion with the formation of a college-wide Inclusive Culture Council and a coordinated, accountable effort to implement concrete department- and program-level actions to align with the campus IDEA Plan.

However, I am more proud of how our community excelled in the face of enormous challenges during this time. From the COVID-19 pandemic and Boulder King Soopers shooting to protests over racial injustice and the recent devastating fires in Louisville and Superior, our community has rallied around those who have experienced hardships, uncertainty and sorrow.

Through those challenges, the college has worked tirelessly to build an even stronger, more resilient CU Engineering community.

Harnessing the power of virtual events, we have increased engagement with our alumni community. We have strengthened our focus on student success and mental health, building on a community wellness values statement adopted in 2019.

I look forward to what we will accomplish together in the years to come. We're launching a new Engineering Residential Community, which we will share more about in upcoming communications. Our innovative Quantum Engineering Initiative, evolving Interdisciplinary Research Themes, and growing materials science and biomedical engineering programs hold much promise for research and educational innovation.

Overall, we remain committed to responding to global societal and scientific challenges and to educating the diverse, world-class engineers who will meet future challenges. We hope you enjoy this edition of *CU Engineering* magazine, which focuses on how our students and faculty are addressing sustainability and the threats of climate change.

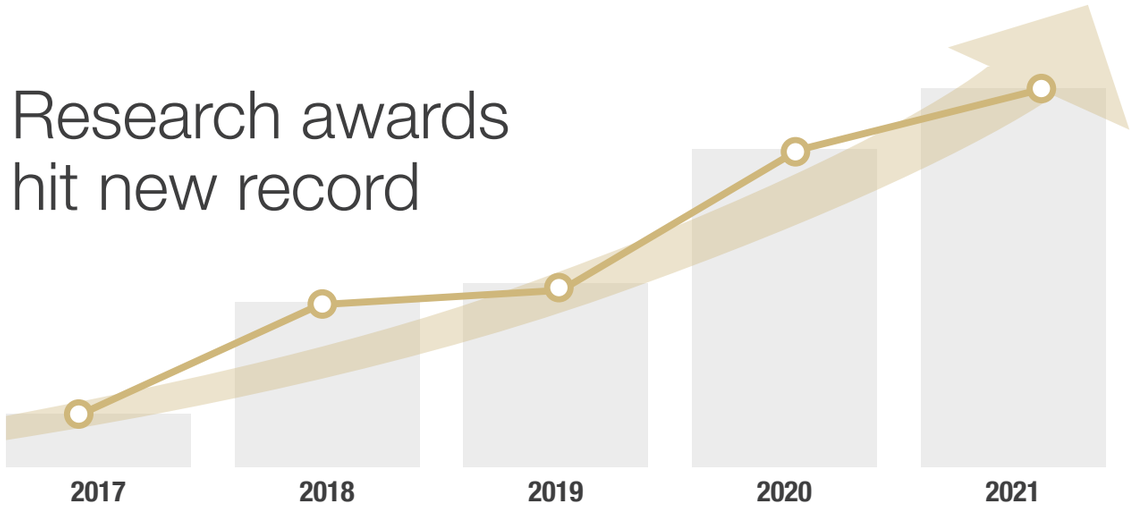
Go, Buffs!

Keith Molenaar
Acting Dean

Back in Session

From alumni events to in-person classes and project expos, we loved welcoming everyone back to campus this year!

Research awards hit new record



CU Engineering experienced another record-breaking year for research funding in 2021, receiving $150 million overall, eclipsing the 2020 total of $134 million. Awards in the college have experienced a strong year-over-year upward trend, with the largest funding sources being federal agencies like NASA, the National Science Foundation and the Department of Defense. While awards were relatively evenly spread among the college, the Ann and H.J. Smead Department of Aerospace Engineering Sciences totaled just over $53 million in research funding in 2021. That betters its 2020 total of $33.5 million and is by far the most ever for that department.

Making it official

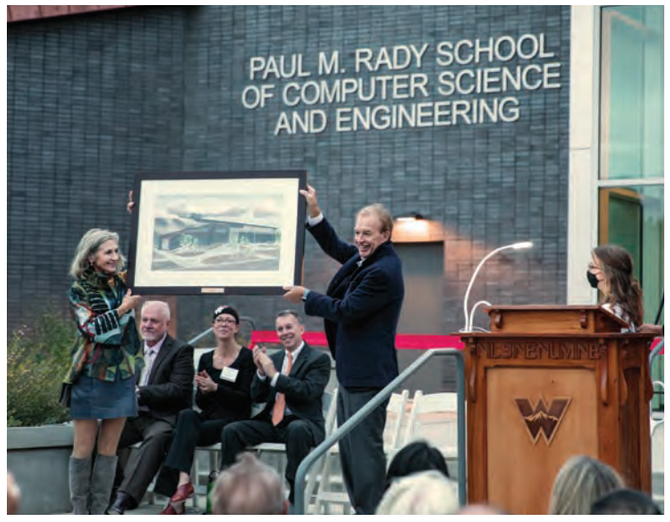
University VIPs cut the ribbon during the in-person grand opening of the Rustandy Building in November. Since January 2021, students, faculty and staff have been taking advantage of the new 45,000-square-foot building connecting the business and engineering schools, enjoying its classroom and collaboration spaces, as well as its extraordinary Flatirons views.

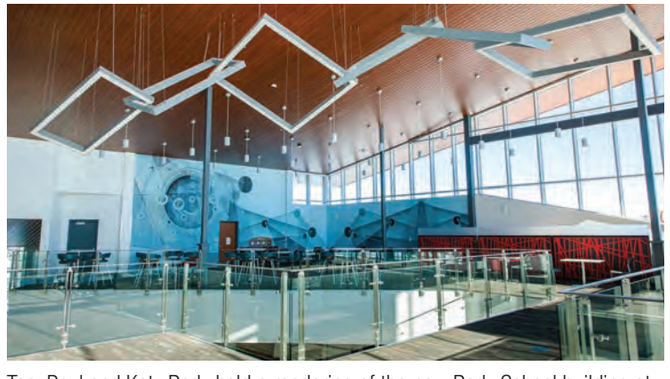
College and BOLD leadership prepare to snip during the ribbon-cutting ceremony for the renovated BOLD Center in November 2021. The renovation was made possible by Marco Campos (CivEngr'98), fourth from left, and his company, Campos EPC, which provided $1 million through the Campos EPC Foundation. The renovation improves the center's technological offerings, allowing for remote and in-person learning. It also provides more space for students and opportunities for students to create cultural displays, engineering projects and artwork.

Gunnison ribbon-cutting highlights valued partnership

Western Colorado University hosted an official ribbon-cutting for the Paul M. Rady Building in October. The new 75,000-square-foot facility is home to the Western-CU Boulder Partnership Program at the Paul M. Rady School of Computer Science and Engineering.

University of Colorado President Todd Saliman, CU Boulder Chancellor Philip DiStefano and CU Engineering Acting Dean Keith Molenaar were among those attending the event in Gunnison — indicating how valuable the partnership between Western and CU Boulder is. It allows Western students to earn a bachelor's degree from CU Boulder in mechanical engineering or computer science, all from the Western campus in Gunnison.





Top: Paul and Katy Rady hold a rendering of the new Rady School building at the ribbon-cutting event in Gunnison.

Above: The interior atrium provides natural light and scenic vistas.

New civil engineering program receives accreditation

The University of Colorado Boulder and Colorado Mesa University's partnership degree program in civil engineering has been accredited by the Engineering Accreditation Commission of ABET, the global accreditor of college and university programs in applied and natural science, computing, engineering, and engineering technology.

ABET accreditation ensures that programs meet standards to produce graduates ready to enter critical technical fields that are leading the way in innovation and emerging technologies, as well as anticipating the welfare and safety needs of the public.

"We're proud to receive this important certification from ABET for our civil engineering degree," said Nathan McNeill, director of the CMU-CU Boulder Engineering Partnership Program. "This allows our graduates to have a shorter path to licensure, which is critical in the civil engineering profession."

The civil engineering partnership program was launched in 2016 and graduated its first cohort in 2020. The partnership between CU Boulder and CMU is a unique opportunity for students to earn a CU Boulder engineering degree while studying in Grand Junction, Colorado. The program offers mechanical, civil, or electrical and computer engineering degrees with the same curriculum as their CU Boulder counterparts.

CU Engineering establishes Inclusive Culture Council

College faculty voted overwhelmingly in spring 2021 to establish an official, permanent committee focused on diversity, equity and inclusion in the College of Engineering and Applied Science.

The mission of the Inclusive Culture Council, which convened in fall 2021 with more than 20 nominated faculty and staff members, is to provide strategic leadership and transparency for cultivating an inclusive, equitable, interculturally competent, and supportive environment in the college.

The ICC strives to bring justice, equity, diversity and inclusion leaders within the college together for systematic, intentional and integrative planning and to formalize equitable and inclusive practices with established metrics.

Terri Wright
Assistant Dean for Access, Inclusion & Student Programs

Amy Moreno-Sherwood
Director of Inclusive Culture

Led by Assistant Dean for Access, Inclusion and Student Programs Terri Wright and Director of Inclusive Culture Amy Moreno-Sherwood, the council will work closely with the college's representative to the campus IDEA Council to ensure alignment with the university's overall equity, diversity and inclusion goals.

College responds to international student challenges

During the COVID-19 pandemic, closed borders, canceled flight routes, quarantine requirements and changes to student visa protocols have upended life for CU's international community.

In response, the college has launched an International Student Advisory Board to better understand and respond to international student needs, both during and after the pandemic.

Composed of 10 students across academic levels and departments, the ISAB meets monthly to identify projects and set goals the board wishes to achieve. Projects this year were focused on creating more professional development opportunities for international students, fostering a greater sense of community, and connecting with new international students as they navigate CU Boulder's campus and U.S. academic culture.

Search for new engineering dean progresses

In October, Provost Russell Moore announced the formation of a search committee made up of representatives from all stakeholder groups in the college, including faculty, staff, students and alumni. A job description was published in November, and the campus began accepting both internal and external nominations and applications for the position. Five finalists have been selected, and Moore plans to name a new dean in the spring 2022 semester.

Raytheon Intelligence & Space creates $250,000 fellowship endowment

Raytheon Intelligence & Space, a Raytheon Technologies business, and the University of Colorado Boulder in June announced the creation of the Raytheon Technologies Endowed Graduate Fellowship Fund. The $250,000 endowment will support top graduate students in the College of Engineering and Applied Science.

"The next generation of engineers are the key to continuing our robust space solutions offerings," said Paul Meyer, vice president, Space & C2 Systems at RI&S. "The partnership with CU Boulder is a critical step toward supporting future innovation in the aerospace and defense arena."

The fund provides fellowship support for tuition, fees and activities that aid in learning or professional development for selected graduate students in the Ann and H.J. Smead Department of Aerospace Engineering Sciences. Fellowships are for one academic year and have been awarded since fall 2021.

3 named to national academies

Three CU Engineering faculty members were named to national academies in 2021.

Chris Bowman of chemical and biological engineering was inducted into the National Academy of Engineering for his innovations related to photopolymerization, a process that uses light to trigger reactions that form new polymers. These polymers are used for an array of medical and technological applications, such as 3D printing, dental fillings, medical devices and augmented reality displays.

Selection for the National Academy of Engineering signifies a member's outstanding achievements in engineering research and education, whether in established fields or emerging technologies. Bowman was previously named to the National Academy of Medicine in 2018.

Mark Rentschler and Greg Rieker of the Paul M. Rady Department of Mechanical Engineering were also named senior members of the National Academy of Inventors.

Rentschler's patent success can be seen at his medical device startup, Aspero Medical. The company recently received a patent for medical balloon technology to improve anchoring consistency in the gastrointestinal tract.

Rieker's company, LongPath Technology, has found success, as well, and was named the 2021 Colorado Photonics Company of the Year. LongPath uses laser technology to help oil and gas companies monitor methane and detect leaks across large areas of infrastructure.

NAI senior members are recognized for having produced technologies that have brought, or aspire to bring, real impact to the welfare of society. They are also recognized for educating and mentoring the next generation of inventors.

See the latest list of National Academy members: colorado.edu/engineering/nae

Chris Bowman

Mark Rentschler

Greg Rieker

SMOKE IN THE WATER

By Josh Rhoten

Engineers examine effects on land and water after wildfires are extinguished

The three largest wildfires in Colorado's known history all occurred in 2020. More than 600,000 acres burned, with the Cameron Peak Fire alone causing $6 million in property damage.

While the last embers of the Cameron Peak Fire are long since extinguished, researchers are increasingly worried about how the remnants of those burns — and future fires — may threaten water supplies across the West.

Environmental engineering Professor Fernando Rosario-Ortiz said the chemical reactions that occur during a wildfire can lead to health and safety concerns when contaminants are released into water, in addition to the more visible and immediate effect on air quality.

"This is especially true in the context of fires at the wildland-urban interface, where if a home burns, we are talking about combusting everything inside those homes — from cleaning chemicals to, potentially, electric vehicle car batteries," he said. "Better understanding all of those reactions with exposure to water is something that we will definitely need to explore further over the next few years."

Fernando Rosario-Ortiz
Professor, Environmental Engineering

Wildfires are becoming increasingly common in Colorado and the West, thanks to climate change and land management processes over the last 30 years, which sought to suppress wildfires as quickly as possible. That combination has resulted in longer, more intense wildfire seasons that lead to larger, more intense burns due to dense vegetation growth.

When it comes to water and wildfire, though, Rosario-Ortiz and his colleagues are increasingly interested in the "burn scars" fires leave behind. Wildfires destroy the vegetation that holds soil in place. Without it, heavy rains can push mud and sediment onto interstate highways. Or carry bacteria and freshly formed toxic compounds from the fire into freshwater supplies — causing headaches for treatment facilities.

Meanwhile, water contamination from burns could also limit freshwater sources during tight drought seasons.

Ben Livneh
Assistant Professor, Civil, Environmental and Architectural Engineering

Rosario-Ortiz and colleagues have been going into the field to collect samples from burn scars in California, Colorado, Kansas and Alberta, Canada, for analysis in the lab. They hope to better understand how ash can affect watersheds as it creates and spreads a wide range of potentially harmful organic compounds.

"Our results from that work show the complexity of how a wildfire can impact water quality," Rosario-Ortiz said. "(Our recent study in Science of the Total Environment) is the first of its kind to identify a specific suite of aromatic acids in wildfire ash and surface water samples. And it will help with the broader discussion and understanding around the nature of dissolved organic matter and the impacts of wildfire on water quality and drinking water sources."

While Rosario-Ortiz and others are focused on water quality and chemistry, Assistant Professor Ben Livneh is studying these kinds of issues from another direction. As a physical hydrologist, he and his research group explore how climate and landscape changes affect how much water is available in an area — and when. His work also examines how fires and rain can influence landslide risk.

His team is working on NASA-funded research that studies 5,000 landslide sites around the world. So far, they found that sites that had a fire in the past three years required less precipitation to cause a landslide.

"But there's also a lot of local variability that really matters," said Livneh, who was also recently appointed director of Western Water Assessment. "We now have a lot of people who have built structures on steep slopes in these areas, so there's a human element there, too. And the time of the year that it happens can be crucial. For example, when a fire occurs right before a large storm can be critical, like we saw in Glenwood Springs, Colorado, this past summer."

Livneh added that as rain becomes more prevalent due to climate change, leaders, researchers and communities affected by slides and other interrelated problems will have to keep an open mind and work together to solve them.

"Management is a policy problem, and in the next 10 years we're going to continue to have these big fires and see their impacts," he said. "But the more open-minded we can be about managing for these things, the better. I'm kind of an optimist. As humans, we've overcome so many technical challenges, and I think we can continue to do so here and in the future."

Soil and water samples from Bennett Creek in the Rio Grande National Forest.

Researchers from Rosario-Ortiz's lab collect water samples from a creek running through a burn area.

Up close at the wildland-urban interface

The effects of wildland fires hit close to home for the CU Boulder community in late December.

The Marshall Fire, which spread through Superior, Louisville and unincorporated areas of Boulder County, became the most destructive fire in Colorado's history. More than 1,000 homes and businesses were lost, and approximately 6,000 acres burned. More than 60 CU Engineering faculty and staff were affected, as well as many undergrads, graduate students and alumni.

CU Boulder researchers — including those from engineering — immediately swung into action to learn all they could to help in future disasters.

In February, Assistant Research Professor Brad Wham and colleagues from Oregon State and Purdue universities used drones to survey the damage as part of an initiative funded by the National Science Foundation that deploys researchers to disaster sites around the world.

Wham and his team hope to better understand the disaster from a uniquely engineering perspective: Why did some houses burn, for example, while neighboring homes survived? How did critical services like water, gas and electricity hold up during one of the worst disasters in Boulder County's history?

Researchers watch a drone take off from the Spanish Hills neighborhood.

"I think what we're doing here is going to be beneficial in the future, especially with other communities that are going to have fires," said Jessica Ramos, a senior civil engineering major who's working on Wham's research team.

The team planned to publish its initial findings through a publicly available report in March.

— Dan Strain contributed to this report.

Read more: colorado.edu/today/2022/marshall-fire-drones

Closer to home

By Jeff Zehnder

Award-winning Solar Decathlon team tackles new Boulder project

Call it the ultimate hands-on student project. A team of students is gearing up to build an entire zero-energy house, an initiative that will test their technical skills and creativity.

The University of Colorado Boulder Solar Decathlon team is taking part in a U.S. Department of Energy national college competition to design and build an affordable, energy-efficient home.

"It's about bringing newer and more sustainable home designs to industry."

"It's about bringing newer and more sustainable home designs to industry," said Wes McEvoy, a sophomore electrical engineering student and co-leader for the CU Boulder team.

They have partnered with Habitat for Humanity and the city of Boulder to build a new home in the Ponderosa affordable-housing revitalization project in North Boulder.

The team of about 30 students has split into five subgroups — architecture, structural, electrical, HVAC and systems — to revamp an existing design to incorporate more sustainable solutions and make it net zero energy.

"We're putting a lot of emphasis on envelope design with insulation and airtightness. We're going to bring in a standard called Passive House that goes above and beyond local code," said Kyle Biega, an architectural engineering master's student and fellow team co-leader.

The group has big shoes to fill. CU Boulder has excelled in past Solar Decathlon events, earning first place nationally in 2021 — the third time a campus team has topped the competition.

Last year's build was in Frasier, Colorado, and Biega is excited the project will be in Boulder this time.

The Solar Decathlon team hosts several design charrettes throughout the competition to get input from industry partners.

"I can't say enough about the amazing design last year. It was in a mountain town — traveling out there was difficult, the logistics were difficult," Biega said. "It turned out so well, but with this project we feel we can get a lot of student and local community involvement because it's right here in our backyard."

A critical focus of the competition is repeatability — is the design sustainable both environmentally and financially?

"All of our design decisions come back to that. We want to demonstrate that sustainable design can be affordable, even in affordable housing markets," McEvoy said.

The team, which is composed of students from across engineering disciplines and from the Program in Environmental Design, is exploring using prefabricated panels wherever possible, installing smart electronic systems, and using passive and active solar.

"We want to be able to showcase to the community all the things you can do in a home design to make it better for the environment," Biega said, giving the example of free ways to cool a home using orientation and shading. "We're delivering the most effective low-cost systems we can implement."

The competition spans two years. The team has spent the last several months on design and expects to make a final presentation to the Department of Energy in April 2022. Construction is expected to begin this summer, with work completed in early 2023.

"Residential design and build is what I want to get into for a profession," Biega said. "The competition is almost a full-time job . . . but for me, knowing we can make a positive impact — not just in the building industry but also our local community — means so much."

"We want to demonstrate that sustainable design can be affordable."

SPARC of success

In April 2021, the CU Boulder Solar Decathlon team took home first place overall in the 2020 Solar Decathlon Build Challenge, which was delayed for a year due to COVID-19. Their victory included top rankings in nearly every category, from engineering and architecture to market potential and innovation.

The "SPARC" house (Sustainability, Performance, Attainability, Resilience and Community) represented the efforts of more than 30 students since 2017. Its goal was to address the housing attainability crisis and construction challenges faced by mountain towns across the country.

Fraser residents Kristen Taddonio and Joe Smyth helped to fund the project and have been living in the SPARC house since its completion. The two-story, 1,176-square-foot home includes a separate rental unit and is so efficient that they have been selling energy back to the power grid, even during frigid mountain winters.

Learn more:
cubouldersolardecathlon.com

Getting there from here

Story by Jonathan Raab, illustration by Brad Baxley

Researchers take steps toward radical transformation in sustainable transportation

Transportation remains one of the key challenges in the push toward broad adoption of renewable and sustainable energy infrastructure. Research into sustainable transportation — from fuel sources to infrastructure to the societal and ethical impacts — can be found across the College of Engineering and Applied Science.

Professor Hendrik Heinz and his group in the Department of Chemical and Biological Engineering are exploring fuel source alternatives and their technological implications. Specifically, they are developing new computational tools and models to better understand how vehicle fuel cells can safely and efficiently convert hydrogen to water to produce the electricity needed to operate.

"When pursuing any sustainability goal, we have to make sure that the outcomes benefit everyone, not just a small subset of people."

"For decades, researchers have struggled to predict the complex processes needed for this work, though enormous progress has been made using nanoplates, nanowires and many other nanostructures," Heinz said. "To address this, we have developed models for metal nanostructures and oxygen, water and metal interactions that exceed the accuracy of current quantum methods by more than 10 times."

Their computational methods will play a role in the widespread commercialization of hydrogen fuel sources in vehicles, but the challenge goes beyond individual research projects. It is comprehensive, requiring a bridging of science, engineering, environmental studies and civil planning in a decades-long transition.

Collaborative effort

The Advancing Sustainability Through Powered Infrastructure for Roadway Electrification (ASPIRE) Engineering Research Center is dedicated to exploring possible multifaceted solutions to widespread electric vehicle adoption, including electrified highways that charge vehicles on the go, charging station deployment, and the workforce and data challenges associated with a massive sustainable infrastructure upgrade.

"Our faculty members are conducting cutting-edge research on a number of topics that are critical for sustainable transportation," said computer scientist Qin "Christine" Lv, CU Boulder campus director and data research thrust lead for ASPIRE. "This includes power electronics for electric vehicles and charging infrastructure; power and energy systems; transportation asset management; built infrastructure and society; air quality impacts of energy and transportation systems; data-driven modeling and system optimization; as well as engineering education."

Learn more about ASPIRE:
colorado.edu/center/aspire

Hendrik Heinz, left, and his group work on computational methods for hydrogen-powered vehicles.

Lv noted that these diverse research priorities require extensive collaboration and communication.

"ASPIRE integrates efforts across multiple disciplines, including engineering, social science, policy and business through close collaboration with industry, government and community partners," Lv said. "Transformations are targeted across the transportation and electric utility industries, leading to significant growth in domestic jobs and energy production, improved air quality and public health."

Lv hopes that research coming out of ASPIRE will contribute to the reduction and stabilization of transportation and logistics costs, as well as to developing the diverse engineering workforce that will be needed for radical infrastructure transformation.

Social context

The rollout of any new technology will also have to be carefully considered in a social context, said Assistant Professor Kyri Baker of the Department of Civil, Environmental and Architectural Engineering. Baker has done research into how the widespread adoption of electric vehicles may affect already vulnerable communities.

"When pursuing any sort of sustainability goal, we have to make sure that the outcomes benefit everyone, not just a small subset of people," Baker said. "Sustainable transportation is a perfect example of an area where we have to be very cognizant of the assumptions we make and the impact of the systems we design."

Baker argues that electrifying public transportation is a worthwhile goal, but residents without access to home charging stations simply would not benefit as much as those with dedicated home chargers. The electricity required to charge a single electric vehicle can be more than a typical house consumes in a single day, her research shows.

Such a radical reallocation of power across our infrastructure will have unforeseen consequences, especially considering the 30% of U.S. households that already face energy insecurity, according to the Energy Information Administration.

"There won't be a silver bullet for every problem in sustainable transportation, but as scientists and engineers, we just need to remember to try to design systems that maximize benefit for a diverse range of communities," Baker said.

Qin "Christine" Lv
Professor,
Computer Science;
Research lead, ASPIRE

Kyri Baker
Assistant Professor,
Civil, Environmental and
Architectural Engineering

Critical research areas for sustainable transportation

- Power electronics for electric vehicles and charging infrastructure
- Power and energy systems
- Transportation asset management
- Built infrastructure and society
- Air quality impacts of energy and transportation systems
- Data-driven modeling and system optimization
- Engineering education

In the air, on the ground and everywhere in between

By Josh Rhoten

Engineers put remote sensing to work for sustainability

Farmers know how much fertilizer they spread over their fields each year and how much water they use every day. But fine-tuning those amounts can be a challenge because the results from the field either are not available or are hard to analyze.

But what if there were a few tiny, wirelessly linked sensors lodged inside plants throughout their fields? The sensors would constantly measure ambient air temperatures or soil moisture levels and report back in real time about potential issues in their specific sections. They could even test a plant's sap frequently to check key metrics for growth and suggest actions farmers could take to improve them.

REMOTE SENSING CAN HELP SOLVE FOOD SUPPLY, POLLUTION AND WATER SCARCITY PROBLEMS.

Engineers at CU Boulder are working to make that a reality. It's one of many interdisciplinary efforts to use the power and promise of remote sensing to help solve food supply, pollution and water scarcity problems around the globe.

Elliot Strand is a PhD candidate in the Materials Science and Engineering Program, studying with Professors Greg Whiting and Robert McLeod. He leads a project that focuses on creating fully printed ion-selective organic electrochemical transistors that can detect macronutrient concentrations in whole plant sap.

Essentially, Strand said, the team has developed a sort of "diabetes test strip for plants" that can quickly measure nutrients like potassium.

"To collect the data, we simply take a drop of sap and put it on these cheap, flexible and disposable sensors," Strand said. "The best part is we can quickly 3D print these sensors on basically anything — even paper. That means we don't need expensive and complicated equipment way out in the field to get this valuable, real-time data, and it opens up opportunities to compost or recycle the material after use."

THE TEAM HAS DEVELOPED A SORT OF DIABETES TEST STRIP FOR PLANTS.

Whiting, a professor in mechanical engineering, said the next phases of the research will likely focus on inserting these sensors into plants. The team will also be looking at different metrics that can be tracked, such as air temperature or specific plant hormones.

A high-level goal when it comes to sustainability, he said, would be helping farmers increase crop yields by fine-tuning the use of water and fertilizer based on sensor readings.

"We have developed a very real stepping stone towards those goals that is also quite usable right now for agriculture or conservation work," he said.

Strand drops a sap sample onto a test strip, seen in detail below.

Reducing drought effects

While Whiting and his team are approaching these problems from the ground, Associate Professor Evan Thomas is coming in from the air. As director of the Mortenson Center in Global Engineering, he and his team are developing the Drought Resilience Impact Platform (DRIP), an integrated systems-based approach to reducing the effects of drought and improving water quality and soil health.

The platform combines NASA satellite data about drought conditions with information from sensors installed on groundwater pumps across hundreds of sites in Africa that alert the network if a pump is failing or in need of routine maintenance. This dual approach — along with modeling and other work — is being used to ensure communities in Kenya and Ethiopia have the knowledge, access and infrastructure to get the water they need.

Evan Thomas
Director, Mortenson Center in Global Engineering

Thomas said the interdisciplinary work showcased in DRIP and related projects is a great example of the work that needed to be done over the next decade around the globe.

"This platform can also be used in Colorado or anywhere around the globe where water is becoming a scarce resource," Thomas said. "Over the next few years, I hope we can start to get this data into the hands of regional providers and leaders on the ground to help inform their decision-making and potentially avoid costly and dangerous drought emergencies."

A groundwater pump station in Turkana, Kenya.

Tri-Executive Ben Capeloto outside the CU Student Government offices.

Another dimension

By Rachel Leuthauser

CU engineers bring technical expertise and skills to policymaking

From air quality improvements to aerospace innovation, the underlying goal of any engineering project is to solve real problems and enhance lives.

Public policy is another dimension to that same pursuit — finding effective solutions for issues impacting society. When policymakers tackle those issues, engineers are often the valuable expert voices, offering concrete and quantifiable solutions.

> "When you get people who think differently about problems … there is a lot of room for creative thinking and really transformative outcomes."

"When you get people who think differently about problems, who all have an earnest desire to solve them and want to provide a benefit to society, there is a lot of room for creative thinking and really transformative outcomes," said Marcus Holzinger, an associate professor in aerospace engineering sciences.

Holzinger has been working on space situational awareness and space traffic management for 15 years. The subject is growing increasingly important as more nations and companies launch satellites, leading Holzinger to testify before Congress in July 2021.

His testimony focused on developing orbital space rules to avoid collisions.

"When we start talking about public policy related to disciplines like space traffic management, there can be a lack of folks with technical backgrounds that engage at those levels," Holzinger said. "The field is always evolving, so it is important to have experts that are in touch with what is currently happening."

Marcus Holzinger
Associate Professor,
Aerospace Engineering
Sciences

A similar case can be made for policy decisions involving air pollution. In Colorado, those decisions are made by the Air Quality Control Commission.

Jana Milford, a professor in mechanical and environmental engineering, serves on that commission, providing insight to improve regulations on emissions.

"Air pollution and air quality are such critical problems facing society because there are tremendous environmental and human health implications," Milford said. "They are important problems for society to grapple with and areas where the technical information is important to inform policy decisions."

Holzinger, left, chats with Colorado Sen. John Hickenlooper, right, after his congressional appearance.

Milford uses her engineering experience to help ensure the regulations created are both technically feasible and economically reasonable.

"I am able to recognize when considerations have been left out or start to be misrepresented," Milford said. "There are often a lot of uncertainties associated with how regulations might play out. Bringing some engineering judgment helps to assess the likelihood of one outcome or another."

Real-world impacts by faculty like Milford and Holzinger are also inspiring future engineers like Ben Capeloto.

> "I am able to recognize when considerations have been left out or start to be misrepresented."

Capeloto is a senior majoring in aerospace with a minor in computer science. He is the first engineer to serve as a University of Colorado Boulder Student Government president in two decades.

Capeloto is one of three student body presidents, referred to as tri-executives, who were elected in April 2021. Their main mission in the past year has been to address mental health on campus during the COVID-19 pandemic. Capeloto has gravitated to other scientific issues, as well.

"There have been a lot of opportunities to give our input on science issues such as COVID-19 and climate change, for example," Capeloto said. "We have supported student environmental initiatives across campus, allowing me to talk about scientific issues in a scientific way. I really enjoy contributing to that coming from a STEM background."

After he graduates, Capeloto hopes to work in the aerospace industry. Then, perhaps one day, he will follow the lead of faculty like Holzinger and Milford to use his expertise on a state or federal policymaking platform.

"Visualizing and understanding issues at a much higher level than policymakers with no background in engineering is going to be a hugely important element for imposing rules now and in the future," Capeloto said. "If rules are made without technical knowledge, people could find ways to exploit regulations."

Ben Capeloto, right, holds a meeting with his cabinet.

The Groovers' legacy

By Emily Adams

Longtime friendship inspires engineering scholarship

The first official "Groovers" photo was taken in the hallway of an off-campus house in Boulder in 1988. In the most recent one from 2021, the group strikes the same pose outside Bryon Beilman's lake house in Maine.

In the intervening years, there have been photos at weddings, CU football games and half-marathons. They get "a little grayer, a little balder," said Kelly Seibert, but how much they enjoy each others' company clearly never changes.

This academic year, an engineering student received the first Groovers Scholarship, which the group endowed in honor of where they came from and how their CU Boulder educations have helped them get where they are today.

Birth of the Groovers

The five met at Northglenn High School in Northglenn, Colorado. Kelly and Kevin Seibert are brothers, and the rest of the group got to know each other through classes and extracurricular activities.

They reconnected at CU Boulder while living in Andrews Hall, where they'd often meet for meals or study sessions, Beilman said. After two years in the dorms, they decided to get an off-campus apartment together.

The group's name comes from the 1986 film *Fandango* starring Kevin Costner and Judd Nelson.

"The movie is about these friends who said when the first one gets married, they would go on this road trip, looking

for a buried bottle of Dom Perignon somewhere in the desert," Beilman said. "They called themselves the Groovers."

When Kelly Seibert, the last single CU Groover, got married, the group celebrated with a bottle of Dom Perignon.

Giving back

At a CU football game in 2014, Seibert was talking to a CU Engineering development officer about his company sponsoring a senior project when the subject of scholarships came up.

Inspired, Seibert contacted the other Groovers to see if they'd be interested in funding a scholarship as a group. Everyone was immediately on board, he said.

After kicking around a few "goofy" criteria for recipients, they settled on a need-based scholarship, with priority given to Northglenn High School graduates.

"We wanted to find somebody who could benefit how we would've benefited when we were back in college," Seibert said.

All five worked and relied on financial aid to get through college, Beilman said. The group even shared a two-bedroom apartment to keep costs down.

"I can say for certain that we all came from very modest means," he said.

Seibert remembered how they would mark the occasion when one of them did well on a test — "which wasn't very often," he joked.

"A big celebration for us was going down to the store and getting a bag of chips and a bottle of Pace Picante sauce," he said. "That was a huge thing for us. We were always struggling on the financial side."

While the endowment is on the smaller side today, Beilman said, the goal is for it to one day be a full-ride scholarship as each Groover continues to contribute.

Maintaining the bond

Today, all of the Groovers are doing well for themselves. After their time at CU Boulder, several went on to get advanced degrees and explore careers in engineering, business and law.

Beilman said an engineering education provides a solid base for any career, even if you don't use the technical skills you learn.

"Engineering teaches you problem-solving and teaches you the discipline of how things build on each other," he said. "I never actually utilized my electrical engineering degree. But the problem-solving and the background has allowed me to start this company and do everything I've done."

Their time at CU Boulder also spawned a lifelong friendship that the group has maintained across distance and life changes.

The group didn't see each other during 2020 because of the pandemic, but as soon as they felt safe to travel, they headed to Maine for a long weekend of Jet Skiing, bags tournaments and reconnection.

"It's nice because we go without seeing each other for two years, and as soon as we get back together, it's like we're still living with each other back in college," Seibert said.

The Groovers

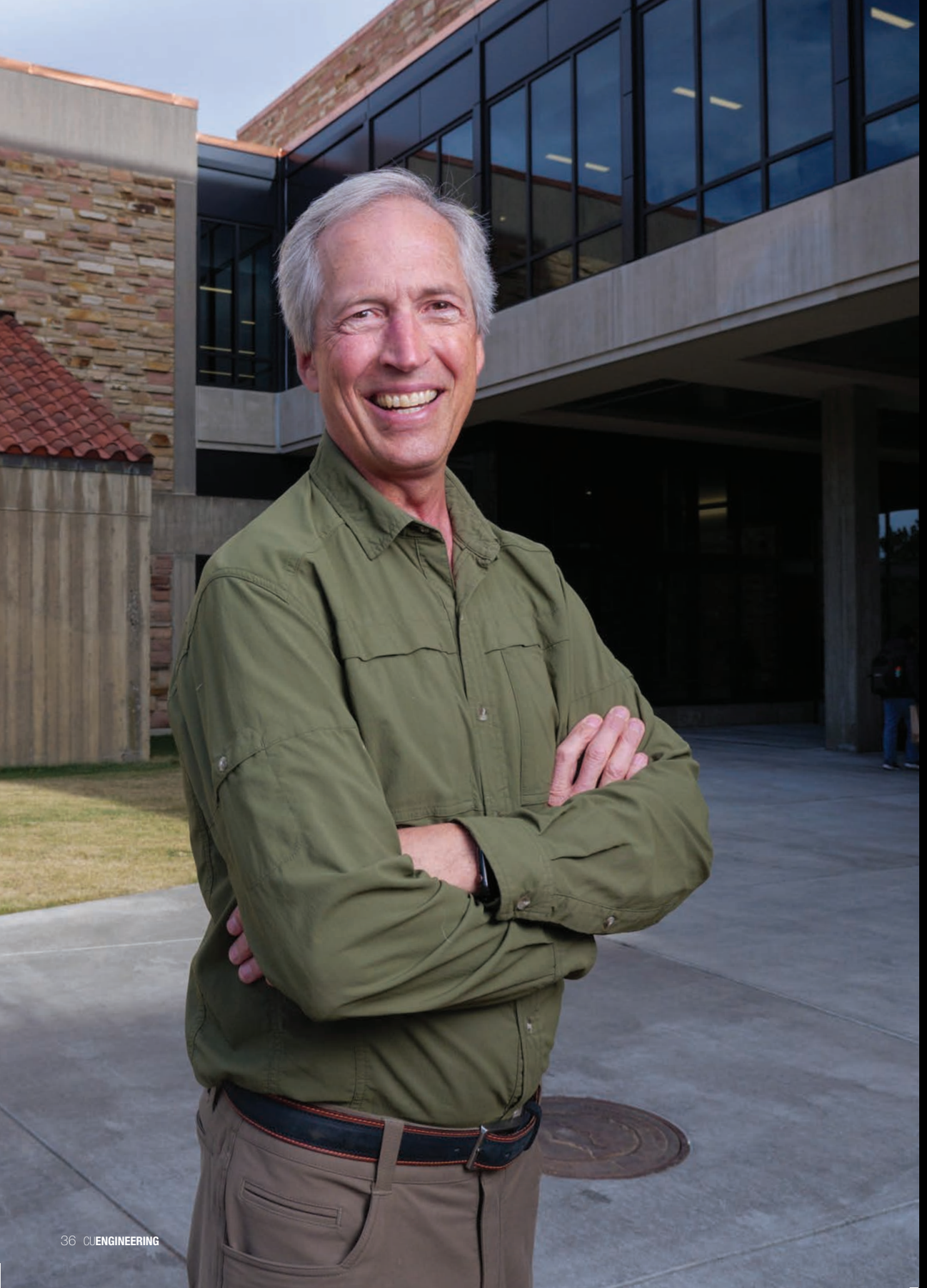
Bryon Beilman (ElCompEngr'91) President, CEO and co-founder of iuvo Technologies

Michael Koertje (Hist, PolSci'89; Law'92) Assistant county attorney in Boulder County

Kelly Seibert (ChemEngr'91) Vice president and general manager of refining, Honeywell UOP

Kevin Seibert (ChemEngr'90) Associate Vice President, Eli Lilly

Mike O'Shea (MechEngr'90) Manager, gas transmission engineering, Xcel Energy



MISSION READY

By Emily Adams

Alumnus launches new startup at CU to inspire climate action

Scott King (ElEngr'85) admits that the idea for his newest business venture "started out kind of dark."

In 2018, King sold ReadyTalk, the communication services company he had founded with his brother Dan King (ChemEngr'82; MBA'89), and retired early. But as the longtime entrepreneur was learning how to be retired, he was also becoming concerned about how former President Donald Trump's administration was approaching climate change.

"Pulling out of the Paris Climate Accord, rolling back emissions, decimating the EPA," he said. "You just watched one thing after another."

Then came the COVID-19 pandemic and the contentious 2020 election. King said he started to feel hopeless about the country's ability to tackle complex issues and started building a shelter in his house to protect his family.

"I woke up one day and I'm like, 'What are you doing? You're designing a bunker in your house. That's not good,'" King said. "I'm a really optimistic person, and I thought there's got to be something I can do besides just taking care of my family."

> "I'm a really optimistic person, and I thought there's got to be something I can do besides just taking care of my family."

So he looked at what he could personally bring to the table when it came to combating climate change.

A team sponsored by King shows off its carbon-zero home design at a project expo in December.

"I had a little bit of money because we sold ReadyTalk, and Dan and I are doing fine. And I know technology, and I know entrepreneurship," he said.

King also knows CU Boulder. In spring 2020, he was co-teaching an entrepreneurship course in the Leeds School of Business. When they transitioned to remote learning, he gave students the option to pivot their business ideas to something that could help their community during the pandemic.

He was heartened by how many took him up on the offer, and he realized CU Boulder was the perfect place to center his new business venture, which he named Mission Zero.

His goal with the company is to harness the knowledge of faculty, passion of students and growing interest from alumni and the business community to engage people in changing their behavior on climate change — from small, everyday actions to how they choose elected officials.

King also wants to help make connections across the university between all the people working on climate change issues. He's been mentoring two electrical and computer engineering senior design teams, working to plan a campus climate conference, providing seed funding for new projects and meeting with anyone who's willing to talk about opportunities.

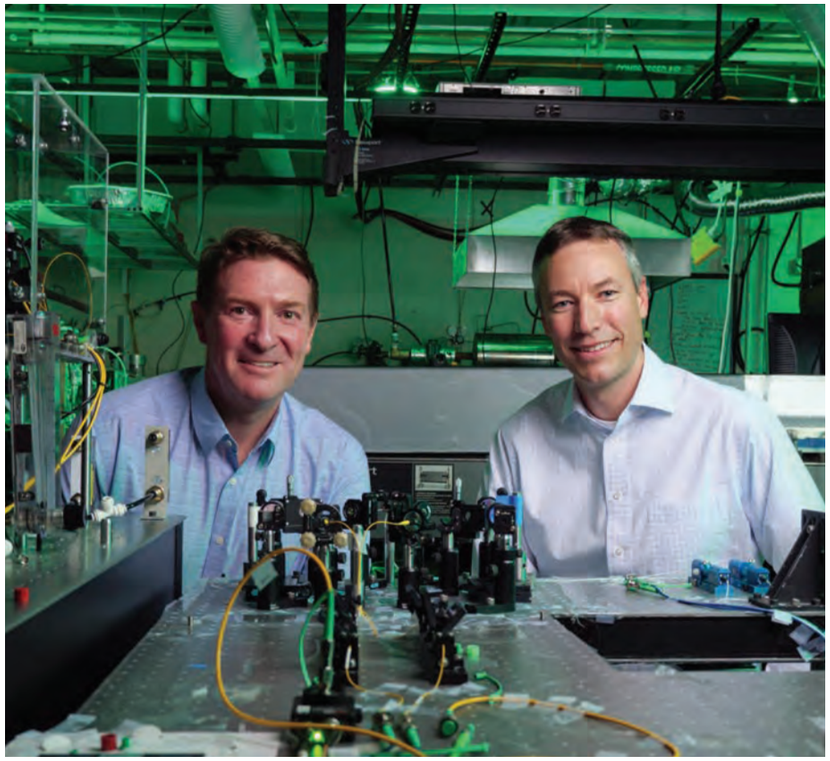
"This is a startup, and it is literally being incubated at CU."

"This is a startup, and it is literally being incubated at CU. We're leaning on students and faculty and advisors and trying to get engagement. Now we're moving on to business leaders, and we'll see if it goes," King said. "But, yeah. I'm not retired anymore."

Learn more about Mission Zero on its YouTube channel.

RESEARCH BRIEFS

New centers, spaces and projects to watch



Scott Diddams, left, with Quantum Engineering Initiative lead Greg Rieker.

NEW INITIATIVE

A quantum leap forward

The college has launched a Quantum Engineering Initiative to expand internal efforts in the field while strengthening connections to local and regional partners.

The initiative marks a significant and strategic investment into translational quantum engineering research — especially in quantum sensing, which has been a strength in the college for years. It specifically includes educational components, faculty hiring efforts and dedicated lab space for collaboration with partners both on and off CU Boulder's campus.

The initiative is a new arm of the existing campuswide CUbit Quantum Initiative, which supports the university and state of Colorado's prominence in quantum information science and technology.

The college took another bold step forward in 2021 by hiring Professor Scott Diddams and several other prominent quantum researchers into faculty roles. Diddams has worked at the National Institute of Standards and Technology for two decades and conducted prominent experimental research in the field of optical frequency combs and quantum metrology with application to atomic clocks and sensors.

Other recent hires include Assistant Professors András Gyenis and Josh Combes. All three are based in the Department of Electrical, Computer and Energy Engineering and are part of a multiyear faculty recruitment plan as part of the Quantum Engineering Initiative.

HEALTH CARE

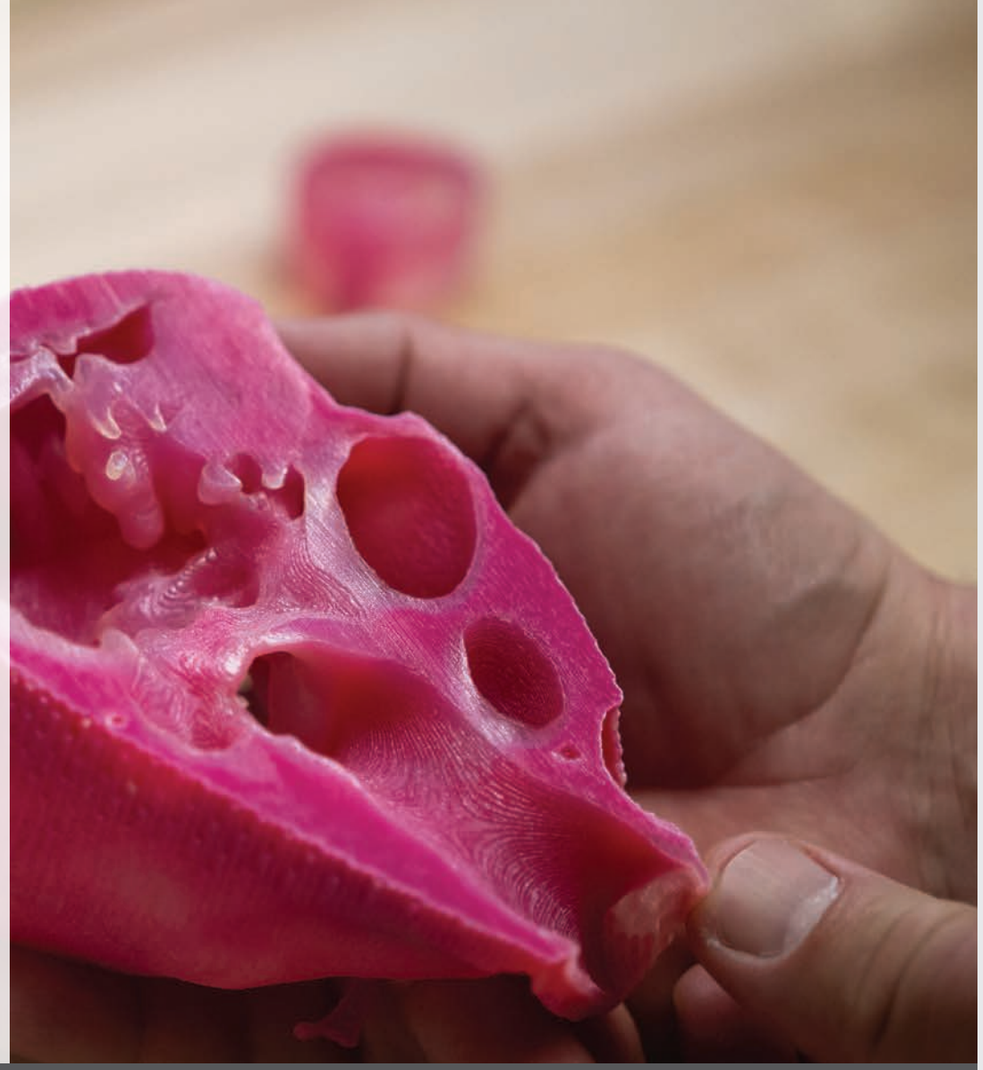
New model for personalized medicine

CU Boulder mechanical engineering researchers have developed a working proof of concept for a process that uses medical images to provide relevant, physical, patient-specific 3D models.

This personalized medicine approach — developed in partnership with CU Anschutz and CU Denver — enables realistic mechanical and morphological features that could revolutionize cancer surgery, for example, where defining the margins of tumors to be removed is critically important.

The partnership was partially funded by the AB Nexus initiative, a $1.2 million effort to fund and support collaborative teams working to improve human well-being, spur innovation and encourage economic development.

The next phase of this work will focus on evaluating existing materials, as well as formulating new ones, to determine appropriate multimaterial mimics for complex biological tissues.



SUSTAINABILITY & EQUITY

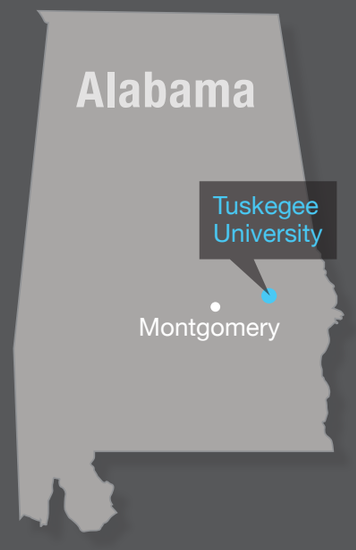
Partnering on a ‘living-learning lab’

Researchers at CU Boulder and Tuskegee University are working together to create a hands-on “living-learning laboratory” for students to connect through a long-term sustainability and equity project.

The project will use 25 acres of land near Tuskegee University to study questions around sustainable agricultural land infrastructure and climate resiliency. That includes testing and designing recycled materials in construction, embedding solar power and creating rainwater catchments.

At the same time, students from both universities will conduct interviews in the surrounding community and reflect on how the culture and history of the area — including colonialism and enslavement — tie into the creation and implementation of their sustainability-focused solutions.

The initial partnership and planning for the project was funded in part by a seed grant from the college’s Resilient Infrastructure with Sustainability and Equity research theme. Other support came from the Mortenson Center in Global Engineering, the Engineering Management Program and the Program in Environmental Design.



SUSTAINABILITY

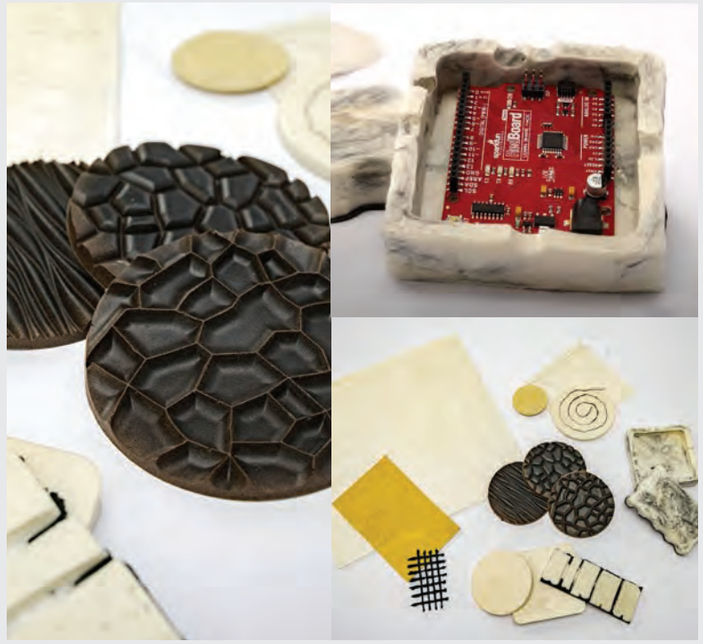
Smart biofoam, less petroleum-based waste

With few options for recycling, most post consumer Styrofoam waste ends up in landfills. Joining the quest to identify more sustainable alternatives, four graduate students associated with the ATLAS Institute are developing a biodegradable, water-soluble “smart” foam, with applications in wearable technology, human-computer interaction and interactive tangible interfaces.

Building on an open-source recipe, the group is the first to embed conductive materials into biofoam, paving the way for sustainable applications, including the creation of pressure sensors to measure force or as a conductive substrate for embedding electronics, where the biofoam would fill the spaces between electronic components within devices.

Biofoam’s soft, flexible and water-soluble material is made from gelatin, glycerin, water and biodegradable dish soap. It also includes locally sourced additives such as tree sap to increase resistance to humidity, flaxseed mucilage to decrease shrinkage during the curing process and powdered walnut hulls as a natural pigment.

Although not biodegradable, the conductive stainless-steel fibers are ideal because they can be easily recovered with a magnet when biofoam is dissolved at the end of its lifespan. The reclaimed fibers can be reused many times. Biofoam could also replace single-use petroleum-based disposable RFID and NFC wristbands and event badges.



NEW FACILITIES

A 21st-century machine shop

A state-of-the-art cleanroom will open on East Campus in fall 2022, offering a dedicated space for collaboration and research that is open for use by the public, faculty, students and staff.

The $7.5 million facility is part of the Colorado Shared Instrumentation in Nanofabrication and Characterization (COSINC), a multidisciplinary core research facility and service center in the college that provides access to equipment for micro- and nanofabrication, nanomaterials characterization and metrology, as well as offering expertise and advanced hands-on training in related areas.

Housed in the Sustainability, Energy and Environment Laboratory (SEEL) building, the cleanroom is the 21st-century machine shop that will enable a wide spectrum of research projects in areas including electronics, photonics, quantum science, and biomedical and nanomedicine.

Completion of the facility is the last step in COSINC's move from the Engineering Center and is part of a $900,000 project to improve and centralize facilities used by the Materials Science and Engineering Program in the same building.

RESEARCH CENTER

Reducing congestion on the RF spectrum

Researchers at CU Boulder are key players in a $25 million, multi-institution effort to study the radio frequency spectrum. The SpectrumX center represents the first federal investment in a national center focused on the transformation of wireless spectrum management.

Many everyday devices, like cell phones and smart home devices, use radio spectrum for their operation. But the spectrum is a limited resource that is already congested — a problem that will only grow with the development of future applications to enable intelligent transportation systems, widespread drone use and 5G communications.

Funded by the National Science Foundation with leadership at CU Boulder through the Ann and H.J. Smead Department of Aerospace Engineering Sciences, the center is led by the University of Notre Dame. It will bring together experts from 29 organizations to transform the landscape of spectrum research, education, collaboration and management.

RESEARCH CENTER

Preparing for entry into other planets

Researchers in Smead Aerospace Engineering Sciences will work with NASA over the next five years to improve entry system technologies for exploring other planets.

The $15 million Advanced Computational Center for Entry System Simulation (ACCESS) will focus on thermal protection systems, which shield spacecraft from the aerodynamic heating experienced during hypersonic entry into the atmosphere. The work is critical to plans for exploration of nearby planets like Mars, which will require placing large payloads safely on the planets' surfaces.

The ACCESS institute is the third project with ties to the College of Engineering and Applied Science selected by NASA for its prestigious Space Technology Research Institute program. Only six have been awarded since 2017.

Moncef Krarti, right, serves as director of the BEST Center.

RESEARCH CENTER

BEST in green building technology

The Building Energy Smart Technologies (BEST) Center is a multi-university initiative to advance sustainable building projects, including HVAC manufacturing, smart glazing for windows, building controls, insulation and solar installations.

Funded by the National Science Foundation under the Industry-University Cooperative Research Centers model, the project is focused on business collaboration, directing research into areas needed for the construction industry and building retrofits. The initial grant will provide $1.5 million over five years, matched by industry associates for a total of at least $3 million.

The BEST Center has already recruited 10 industry partners. Leadership at CU Boulder comes from the Department of Civil, Environmental and Architectural Engineering, with City College of New York serving as a partner site — offering the opportunity to research and test new building technologies in the largest metropolitan area in the United States.

DISTINGUISHED ENGINEERING ALUMNI AWARDS

The Distinguished Engineering Alumni Awards (DEAA) are granted annually to graduates who have distinguished themselves through outstanding personal qualities, knowledge and significant contributions to their fields. The Recent Alumni Award recognizes exceptional alumni for early career achievements, continued involvement with the university and college, and outstanding personal qualities within 10 years of graduation.

C. Ben Nelson

CivEngr'84, MS'88

Principal and chairman, Martin/Martin Consulting Engineers

Distinguished Engineering Alumni Award: *Industry and Commerce*

C. Ben Nelson (CivEngr'84, MS'88) is a principal and serves as chairman of the board for Martin/Martin Consulting Engineers, which provides structural and civil engineering services for projects throughout the world. He has devoted his nearly 40-year career to Martin/Martin, where he contributed to structural engineering projects throughout the U.S. and 10 other countries.

His impact on the CU Boulder campus is unmatched, as he has personally designed or managed over 400 projects in at least 175 of the more than 200 buildings on campus. His most notable new building designs include the Imig Music addition, Jennie Smoly Caruthers Biotechnology Building, Center for Community, Folsom Stadium East Suites, University Memorial Center addition, Basketball/Volleyball Training Facility and Dal Ward Athletic Center.

For more than 30 years, Nelson has served on the Department of Civil, Environmental and Architectural Engineering advisory board. He has also created endowed scholarships for graduate and undergraduate students in the department and served on the college advisory committee.

Jeffrey Quinlan

ArchEngr'92, MCivEngr'94

Vice president, Acuity Brands Lighting

Distinguished Engineering Alumni Award: *Industry and Commerce*

Jeffrey Quinlan (ArchEngr'92, MCivEngr'94) serves as vice president of engineering and illumination at Acuity Brands Lighting, where he has worked for the entirety of his 28-year career. Early in his career, he co-developed what is now a mainstay software used by lighting designers, engineers and sales representatives. Since then, he has continued to develop products and product lines for the company. Quinlan has also been a key player in helping Acuity make the transition to and become a leader in solid state lighting (SSL) for architectural applications, a monumental change in the environmental impact of architectural lighting and human access to electric light worldwide.

In 2011, the longstanding CU Lighting Program was seeking a plan for financial security and wanted to expand its educational reach to nontraditional students. In response, the Rocky Mountain Lighting Academy (RMLA) professional education workshop was developed. Quinlan agreed to serve as a member of the newly created RMLA advisory board in 2012 and helped to secure funding for the program. He continues to serve the program as a board member and by volunteering his time as a faculty member for the RMLA.

RECENT ALUMNI AWARD

Established by the Graduates of the Last Decade (GOLD) Board in 2013, the RAA recognizes one outstanding alumnus/a each year for professional achievements, continued service to the college or university, and admirable personal characteristics within 10 years of graduation from the college.

M. Amin Hariri-Ardebili

MCivEngr'14, PhD'15

Researcher, National Institute of Standards and Technology

Recent Alumni Award

Mohammad Amin Hariri-Ardebili (MCivEngr'14, PhD'15) is a researcher at the National Institute of Standards and Technology (NIST). His main research interests are performance-based earthquake assessment of infrastructures, risk and resilience, alkali-silica reaction, uncertainty quantification, and machine learning. Hariri's impressive body of work includes research activities at NIST that span a range of topics and have yielded more than 100 significant publications and peer-reviewed journal papers. In addition to his exemplary work at NIST, his research impact is reflected in a science-wide author database of standardized citation indicators developed at Stanford University, which named Hariri as one of the top 2% of scientists worldwide.

Hariri is always trying to find opportunities for his alma mater and to support CU research activities. In the past two years, he has served as a thesis committee member for five master's and PhD students and as lead supervisor for one visiting doctoral student. As part of his responsibilities, Hariri oversees making a strong connection between the university and industry. Last year, he helped to facilitate four scholarships from the U.S. Society of Dams for graduate students to cover their summer tuition.

ALUMNI ENGAGEMENT MEDAL AWARD

The Alumni Engagement Medal (AEM) was established in 2021 for college academic degree programs and the BOLD Center to recognize highly engaged alumni who impact their areas through volunteerism and/or philanthropy. Each academic degree program and the BOLD Center is able to select one graduate annually who has been significantly engaged during the previous year. Examples of engagement include outstanding volunteerism such as serving in a volunteer role, event and program support, student engagement, department/degree program advising, and/or philanthropic support.

2022 Awardees

- Christopher Corwin (MCivEngr'07; PhD'10)
- Irene Diep (MEngrMgmt'18)
- Lale Lovell (PhDChemEngr'01)
- Jason Mucilli (ElEngr'07)
- Ram Narayanswamy (PhDElEngr'96)
- Jannine Vela-Rouw (EngrPlus'18)
- Heather Underwood (PhDTechMedSoc'13)
- Alexander Villacorta (MApMath'02)
- David Wolenski (MechEngr'83)
- Christopher Zeller (MAeroEngr'99)

LEADERSHIP UPDATE

Karen Crofton
Entrepreneur in Residence

Karen Crofton has joined the College of Engineering and Applied Science as an entrepreneur in residence. Crofton brings a wealth of experience as an investor in data and financial technology startups, a former principal at the Rocky Mountain Institute dedicated to the transformation of energy systems, an intrapreneur at Air Products & Chemicals, and a lecturer at the Leeds School of Business at CU Boulder.

She holds a bachelor's degree in mechanical engineering from Bucknell University, an MBA from Rice University, and a master's in data analytics from CU Boulder.

Since joining the CU Boulder staff in fall 2020, Crofton has taken the helm of ESCEND™, the college's entrepreneurship initiative. ESCEND combines entrepreneurship courses taught by experienced founders from the Colorado startup ecosystem with co-curricular experiences and cross-campus resources to give students a launchpad for entrepreneurial ventures.

She also leads Catalyze CU, a summerlong startup accelerator program for all CU students, faculty and staff that combines mentorship, funding and dedicated coworking space to help launch promising ventures from across the CU Boulder campus.

Fernando Rosario-Ortiz
Associate Dean for Faculty Advancement

Fernando Rosario-Ortiz began a four-year appointment as associate dean for faculty advancement in July.

This position is responsible for providing leadership and oversight of the college's program to support faculty members across their career stages to accomplish their core missions. The associate dean supports faculty recruitment; manages the annual faculty review process; oversees the First Level Review Committee; advances diversity, equity and inclusion among the faculty; and allocates the necessary resources to those programs.

Rosario-Ortiz joined the CU Boulder faculty in 2008 and has served as director of the Environmental Engineering Program. His research focuses on environmental chemistry, including the impact of wildfires on water quality.

He was selected as a CU Boulder Research and Innovation Office fellow in 2017 and earned the Provost's Faculty Achievement Award in 2016. He earned his bachelor's degree in chemistry from the University of Puerto Rico, Rio Piedras, a master's degree in chemistry from CalTech, and a doctoral degree from the Environmental Science and Engineering Program at UCLA.

Rosario-Ortiz succeeds JoAnn Silverstein, who became the first faculty member to hold this role in the college in 2017.

ESCEND™ turns passions into reality

ESCEND™ offers a full slate of opportunities to help students get from idea to production.

By combining entrepreneurship courses – taught by experienced founders from the Colorado startup ecosystem – with co-curricular experiences and world-class resources, ESCEND gives students the launchpad needed to turn their passions into a reality.

ESCEND is located in the newly remodeled south wing of the Engineering Center on CU Boulder's main campus.

Programs and course offerings include:

- Engineering Entrepreneurship Minor
- Entrepreneurial Product\Development
- Designing for Defense
- Engineering Projects for the Community
- New Venture Creation
- Designing for Defense

Learn more about ESCEND:
colorado.edu/engineering/escend

Left: The new ESCEND space in the south lobby of the Engineering Center. Right: Students participate in an entrepreneurial peer mentorship program.

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