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Our CEM Mission

As staff of the Colorado Engineer, our mission is to inform and educate our readers and reflect pride in CU’s College of Engineering & Applied Science worldwide.

Our student-led magazine seeks to provide a voice for CU’s engineering students while also carrying on the 100-year CEM tradition: by students for students.

The Colorado Engineer has been reporting on the “latest and greatest” from the engineering, science and technology community since 1904. We were there for the Model T, the jet engine, the IBM PC, the iPod — and we will continue to cover the future of human innovation. Today, we operate with a staff of 13 students and four advisers. We publish the magazine biannually, with a readership of over 8,000 individuals, reaching students at the university, researchers, professors and alumni. If you would like to join our staff or have questions and comments, email us at justin.wang@colorado.edu. Alternatively, check out our website at http://www.colorado.edu/studentgroups/colorado-engineer/. We always enjoy hearing our readers’ feedback!

THE ‘FACING THE FUTURE’ ISSUE

Engineering has the potential to be transformative, but we need to maintain a balanced perspective to prepare for the challenges ahead.

This semester marks a big transition for the student body at the University of Colorado. After the majority of students attended school remotely for over a year, we have finally made a more or less complete migration back to campus.

While some things resumed as normal, such as large lecture rooms being filled and the Center for Community dining hall offering buffet-style meals again, campus feels different than it did before the COVID-19 pandemic hit. Social introductions continue to include that “awkward wave” in place of a handshake, and wearing masks remains mandatory while indoors. Nevertheless, school is in session and we have learned to adapt.

The theme of “Facing the Future” seemed very appropriate for the current campus climate. In spite of the ongoing COVID-19 pandemic, new policies were put in place to provide a safe on-campus experience. A vaccine mandate has led to 94% of CU Boulder students and 96% of CU Boulder employees getting vaccinated. This effort caused a significant decrease in on-campus spread of COVID-19, making CU Boulder’s COVID infection rate significantly lower than that of the city of Boulder and the state of Colorado. With mask mandates, the combined efforts of our community have made it safer and more comfortable to be on campus and continue doing our important work.

In this issue, we discuss some of the amazing work being done at the Engineering College that will make our future a better place. Ranging from robots designed to save lives from collapsed buildings to a student-made sounding rocket headed for space, we hope to celebrate the current state of innovation at CU Engineering.

Yet, at the same time, there are things that we feel still need to be addressed. As we adjust to being comfortable working in a global pandemic, the threat of climate change looms over us. In this issue of the Colorado Engineer, we also discuss how climate change has affected our local Boulder community and discuss aspects of the problem that call for attention.

With our campus being so lively and filled with activity now, the state of our community is still much better than it was before the COVID-19 pandemic. Nevertheless, we need to be aware of the challenges the future may present to us. And so, we hope to provide you with some much-needed perspective as we both celebrate making the future a better place for all of us.

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Sincerely,

Justin Wang
Editor-in-Chief
nora drewno | photo by eliot whithead

on march 16, 2020, the university of colorado boulder switched to all remote classes for the remainder of the spring 2020 semester due to the covid-19 pandemic. during the academic school year from 2020 to 2021, most classes were taught remotely with some exceptions made for hybrid labs and recitations. as the vaccine has been widely distributed, cu decided to have in-person classes starting in the fall 2021 semester. we are all adjusting to a new normal and getting used to living in a world with covid. to see how the cu community has been adjusting, the colorado engineer spoke with multiple students and faculty to gather their perspectives on transitioning between online and in-person education.

challenges of remote education
the remote learning environment presented students and professors with many different challenges. dr. murray cox, a service instructor in computer science, mentioned difficulties such as, “getting up to speed with any technology used that is specific to online teaching. online teaching has much more busy-work and organization. students tend not to participate online in the same way they might in-person. it’s hard not being able to read facial expressions or body language. a select number of students tend to be impolite and entitled when they can hide behind a screen. technology introduces a number of errors, mishaps and, or crashes that would otherwise not be a factor in the teachinglearning process.”

mechanical engineering student whitney valencia noted that she was especially bothered by the “distractions, being burnt out, always being in the same place, and the loneliness of never seeing anyone or having anyone to work with.”

sophomore bryan tan, also studying mechanical engineering, had a unique experience as he switched into engineering during the spring 2020 semester. “i was a sophomore in the midst of switching into the engineering school,” he said. “as a person who has never taken calculus nor a math class in the past three years, i struggled a lot with finding valuable study habits, immersing myself in the engineering community and doing everything while keeping my sanity.”

benefits of remote education
despite the challenges of online education, it did afford some benefits. dr. torin clark, a professor in the aerospace department, mentioned how technology is a powerful learning tool when it comes to clicker questions and sharing multimedia content. “breakout rooms offer a great opportunity for peer-to-peer learning when faculty members and tAs can quickly bounce around.” clark said.

valencia emphasized the importance of having recorded lectures and being able to learn course materials at her own pace. she realized that she “doesn’t need to collaborate with peers as much.” tan also learned more about study habits and mental health. “i understand that reading the textbook is very helpful. i know that being on campus helps to keep me productive. exercising and stretching are also very important — i had to learn that the hard way!”

Dr. cox offered these helpful, summary remarks: “teaching is more than transmission of knowledge. If teaching only consisted of providing information then we could all learn from google, or a book, or watching videos.”

self care tips

take walks throughout the day

take breaks from school and from your computer screen

stretch and exercise to increase endorphins and relieve stress

Know your limits

Monitor your mental health, and utilize CU’s Counseling and Psychiatric Services (CAPS)

reach out to friends and family

“online teaching, has much more busy-work and organization. students tend not to participate online in the same way they might in-person.”

How it Feels to Be Back In Person
Making the transition back to in-person learning has been a difficult process for students and faculty. Dr. maureen Lynch, a professor in the mechanical engineering department said she was happy to be back in-person, “but it was very disconcerting at the beginning – being around so many people, teaching really large classes took a while to get accustomed to.” Dr. Lynch said, “managing people getting sick and/or exposed to covid, both folks in my class and just in the community. I don’t want anyone who is sick in my classroom, covid or otherwise. I have two little kids that can’t get vaccinated yet, so I’m definitely a little nervous about breakthroughs.” dr. Lynch also has been having complications with some of her students. “some students are expecting a lot of leeway from professors in terms of assignments, due dates, etc., which we gave a lot of last year, but this year is much more normal.” now professors are going back to our usual expectations, and we students alike are having to adjust.

Dr. cox said, “nostalgia has a way of making me miss the original in-person classes. the current version of in-person is adequate but still lacks something.”

valencia said she was still unsure how she feels about the transition. “I still have some online classes and my harder classes are in-person. I’m not sure if it’s difficult because of the content, or because of the teaching styles.” since being back in-person, valencia mentioned the difficulty of “having to rush to take notes. i really enjoyed being able to go back through past recorded lectures. now i am unable to do that so i must retain what the professor is writing and saying a lot quicker.”

there are some aspects of in-person classes that are more preferable and can’t be beat by the remote learning environment. Tan shared, “seeing people ‘face-to-face’ and seeing old friends are some things i can appreciate.” at the same time, Tan noted how in-person classes are exhausting for him since he “transitioned into the engineering school during covid, so i did have habits that helped me succeed in engineering. having close relationships with peers and mentors is something that takes time to develop – and as an engineer, your time is too valuable.”

Dr. Clark mentioned how managing real-time while focusing on the material and learning outcomes is a challenge for students.

in-person or online?

after experiencing both types of learning, students tend to prefer one mode over the other. Valencia preferred online learning since, “it’s what 3/5 of all my college semesters have been so i am used to it. i really enjoy being able to rewatch lectures and go at my own pace.”

Tan recognizes the pros of online learning but enjoys the in-person aspect. “i think the benefits of online are that it is very less exhausting – commuting to campus, being on campus (plus worrying about food if you’re a certain college student), is very time consuming. being online helps me save a lot of time but the drawback is that I cannot access the full engineering experience, and also felt like i was going a little insane last year. i prefer being in-person since it allows me to have a fuller experience with engineering.”

Dr. Lynch said she preferred in-person classes since during covid, she confirmed she is more of a people person and it’s “so much easier to interact with students and gauge how they’re receiving the material. it’s easier to ask and answer questions.”

my personal experience
when classes transitioned from online to in-person, i was in my second year at CU. While remote learning brought challenges, i learned how to be a better student and how to be more independent. I do enjoy having mostly in-person classes this semester and getting to meet new people even despite some of the challenges.

CU regulations
the university of colorado Boulder does have COVID regulations in place. Masks are required in public indoor spaces starting on August 13, 2021. all students, faculty members, and staff had to fulfill the COVID 19 vaccination requirements by September 15, 2021. CU Boulder’s COVID monitor testing ended on August 6, 2021 but is still available to students and staff through Medical Services.

If you’re feeling sick or are having any symptoms, stay at home to reduce the risk of transmission.

Since September 5th, Boulder County is on a required mask mandate for any indoor spaces. From spring 2020 - fall 2021, CU is taking applications for the Student Emergency Fund in hopes to support students facing financial hardship during the pandemic.

To keep updated with CU Boulder COVID, you can visit the covid-19 Ready Dashboard.
THE GROSS RESERVOIR DAM EXPANSION: DENVER WATER V. BOULDER COUNTY

After a multi-year legal battle over the Gross Reservoir Dam Expansion, Boulder County and Denver Water settled on a $12.5 million agreement. For Boulder County, this decision was not the favored outcome.

N

settled in the mountains, about 26 miles from Boulder via Flagstaff Road. Gross Reservoir holds a portion of the Denver Metro area’s water supply.

The reservoir was built in 1954 by Denver Water’s former Chief Engineer Dwight D. Gross, and after 67 years, Denver Water plans to renovate the dam to address current and future water imbalances. Boulder County raises concerns over the project’s environmental impacts, and questions about its call for more water.

On July 14, 2021, Denver Water sued Boulder County claiming that local authorities are prolonging the implementation of a federally permitted project. For two decades this project has been in contention, but on Nov. 2, 2021 the Board of County Commissioners proposed to pay $12.5 million to mitigate the expansion’s environmental impact.

“At the public hearing over the Denver Water proposal, I heard from residents, taxpayers, and business about their concerns about supporting this project,” Commissioner Claire Levy said in a public statement. “Unfortunately, Boulder County was not in control of this process, and despite our best efforts, a far worse outcome is the most likely result of rejecting the offer. It would have been reckless not to consider an offer that offset at least some of the destructive impacts of this project. Under these circumstances, without a full public consideration of this project through our local review process, we believe the settlement agreement is the best we can get from Denver Water to help compensate our constituents and the environment.

“I found that both the ‘purpose and need’ wasn’t valid and that this was not the least environmentally damaging practicable alternative to water imbalances. “We believe the settlement agreement is the best we can get from Denver Water to help compensate our constituents and the environment.”

“We understand that settling with Denver Water to pay $12.5 million to mitigate the environmental impact statement (EIS).”

He reviewed the purpose and need of the expansion and if the dam raise was the least “environmentally damaging practicable alternative” to water imbalances.

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“Some of the information is 15 plus years old, and they never bothered to update it, because I guess if they had, then they wouldn’t have been able to suggest that there is a purpose and need,” Dr. McCurry said. Denver Water “probably assumed that the people at the Corps of Engineers or the FERC weren’t going to dig into the details, they were just going to read what the report said and go, ‘Okay, approved,’ which is basically what happened.”

In order to manipulate federal land, Denver Water needed approval from the Federal Energy Regulatory Commission (FERC). In Dr. McCurry’s review, Denver Water applied the “least environmentally damaging practicable alternative” to projects. According to Denver Water, the “FEC should determine that both the FEIS and the EA fail to meet the standards of the National Environmental Policy Act (NEPA) and therefore reject staff’s unreasonable approach,” Pearlman wrote.

“NEPA standards require organizations like Denver Water to apply the “least environmentally damaging practicable alternative” to projects. According to the Boulder County Attorney’s memo, “The FERC should only consider the FEIS and the EA as the ‘least environmentally damaging practicable alternative’ to projects.” According to Dr. McCurry’s review, Denver Water proposed five alternatives that attempt to meet standards, but the alternatives cause considerable loss of rare vegetation, wetlands, and habitats.

Boulder County disputes the FERC’s staff advising process of overlooking environmental impact and declaring a need for the project. “Since Denver Water initiated its effort to construct the project, Boulder County has become increasingly concerned that Denver Water’s preferred alternative (of raising the dam) does not meet the purpose and need Denver Water established for the project,” Pearlman wrote. The FERC approved the project in 2020.

Downwards since 2010, even as Colorado’s population increased.

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The COVID-19 pandemic has been an unprecedented time for the world these past two years, and it would seem to the people of Boulder County and the students, faculty, and staff of the University of Colorado Boulder. However, people may be shocked to learn that parts of the 145-year-old campus experienced similar events just over 100 years ago.

The 1918 Influenza first found its way to Colorado on Sept. 19, 1918, according to CU archivist Michael Dombrowski. Though commonly mistaken for the more well-known influenza of 1918-1919 which caused a deadly strain that spread through the United States via many of the American military bases, it was only a matter of time before a temporary hospital in the Sigma Chi fraternity housed more than 30 infected students.

Several other buildings on and around the current CU campus functioned as hospitals, including the Alpha Tau Omega house and the Armory. As the virus spread through the campus and across Boulder county, isolation tents began appearing around campus as well.

In 1918, as well as buildings around the county, closed as the Boulder quarantine began Oct. 7 of that same year. Dombrowski noted that Oct. 10 was the peak of the epidemic in Boulder county, and though the flu still raged throughout the country, it had slowed in Colorado to the point where University and state officials lifted the quarantine. Classes resumed on Nov. 11, the date of the armistice signing for World War I. This project represents outdated planning and thinking. Unfortunately, instead of using our land use process to review this project to address the concerns we heard from the public, we are faced with trying to address these issues in a legal area with a large corporation that holds all the power within the legal framework, being put in a position that does not allow us to stop the expansion of the Gross Reservoir and Dam in line with my own on protecting the natural environment," Martin said. "I can assure you this carries on or for me to our CEO, to our board, to everybody at Denver Water that we have been entrusted with managing a huge, valuable resource. And we take that very seriously, and we want to do it the right way."
When you roam around the maze-like corridors in the Engineering Center building, do you happen to encounter robots moving around by themselves? If you saw the one walking on its four legs, then you have met Spot. How about the robot that looks like a Mars rover? That one is Husky. Both Spot and Husky usually carry around some setup of equipment on their shoulders. They are two out of a dozen robots that CU students and professors built for a competition held by the Defense Advanced Research Projects Agency (DARPA), part of the US Department of Defense. Spot, Husky and the rest of the fleets have been around since 2018 when the DARPA Subterranean challenge started. These robots were designed to work as a team called Multi-Agent Autonomy with Radar-Based Localization for Exploration (MARBLE). The DARPA competition asked participants to create a robot system that can handle challenging underground terrain. In a situation like search and rescue missions, the environments are often too hazardous for human first responders. If you imagine the earth after an earthquake, the rest of the building can still collapse and this kind of condition can be fatal for humans. For that reason, the DARPA team may help us to do the search and rescue function so that we do not put human life in danger.

In the real DARPA challenge, the tasks are too difficult to pass through. If Spot is in communication proximity, Husky can send a message directly to Spot so that Spot can come over to check the chamber. But, if Spot is too far away, Husky will send the signal through the beacon-relay system that has been planted by the robots during exploration. What happens if the communication system gets interrupted and disconnected? The robots are programmed to have some autonomy to decide their next move, but it all depends on circumstances.

In the real DARPA challenge, the tasks that the robots were needed to do were even more complex. In preparation, the MARBLE team tried to get their fleet of robots ready to tackle any possible problem throughout the competition. Miles explained that such a simple task can be tough to do in an underground setting. Miles worked on developing the origin detection process of the system. Typically, we can rely on GPS to tell where we are on earth. Unfortunately, inside the earth, the GPS signal would not work. So, additional measures were done by Miles so that the robots can navigate themselves underground. In the DARPA challenge, one of the tasks is to find and identify objects in order to simulate real-world conditions. When looking for a missing person in a collapsing underground mine, we may need to locate tools left behind, such as shovels or pickaxes. The MARBLE robots have been equipped with cameras and algorithms to do this particular job. But this autonomy is often not enough. As the competition went on, we kept adding more elements of human supervision. It turns out it ends up being the turning point for us in the competition.

The reason that we did really well in the competition is because of the changes that we made on the last day where we gave the human supervisor more capability to take more control of the robots,” explained Dan Riley, a Computer Science PhD student working in the MARBLE team. The field conditions can be unpredictable, and helping the robots make decisions can be overwhelming. Riley, who has more than a decade of experience in the US Air Force, became the human operator to manage the robots in the final competition. With this last-minute modification of the system, the MARBLE team was able to identify many artifacts, an achievement that eventually won them third place in the competition. The reason that we did really well in the competition is because of the changes that we made on the last day where we gave the human supervisor more capability to take more control of the robots,” explained Dan Riley, a Computer Science PhD student working in the MARBLE team. The field conditions can be unpredictable, and helping the robots make decisions can be overwhelming. Riley, who has more than a decade of experience in the US Air Force, became the human operator to manage the robots in the final competition. With this last-minute modification of the system, the MARBLE team was able to identify many artifacts, an achievement that eventually won them third place in the competition.

Undergraduate students also took important roles in the MARBLE team. Daniel Torres joined the team when he was a senior in Mechanical Engineering. Torres led the hardware design and development of the robots. “Even since we started, I really like what we did. I would like to stay on the team,” said Torres. He decided to continue his education at CU as a graduate student in Computer Science and he remains a committed member of the team. Drew Beathard, who is a senior in the Creative Technology Design program, has a unique position in the project. Before joining the team, Beathard was looking for an internship with companies for the summer. With limited internship opportunities, he decided to look for hands-on experience he could find on campus. Beathard reached out to Prof. Christopho Hockman, who is one of the principal investigators of the MARBLE team, asking for a possible project to be involved in. After months in the project, Beathard said, “I could not have asked for a better assignment.” He used many of his skills acquired from classes he has taken, such as rapid prototyping and computer-aided design. Beathard’s involvement has kept him fascinated by working with robotics. “I think it is the perfect combination of all kinds of engineering together. Robotics requires a team of people who have such a wide array of knowledge” added Beathard. Now that the competition is done, Beathard is determined to continue some of his work for his Capstone project for his degree.

There are many interesting things to learn from the MARBLE robots and the team itself. One thing for sure is that a single robot may fail in the field, but a team of robots can be more robust in managing difficult environments. Depending on the situation, human involvement can have a significant benefit on autonomous robot performance. And after all, everyone’s experience in the team has been remarkable. Undergraduates who want to get hands-on experience related to their degree can consider working with CU engineers on campus to create next-generation technology for human kind.”

The U.S. Department of Defense challenges CU students to assemble a fleet of robots.

KEFIN FAJRIAL | PHOTOS COURTESY OF THE MARBLE TEAM

WHAT’S BETTER THAN A ROBOT? A TEAM OF ROBOTS!

Keefin Fajrial

What’s better than a robot? A team of robots! The U.S. Department of Defense challenges CU students to assemble a fleet of robots. Mike Miles, a Mechanical Engineering PhD student in the team. Mike Miles, a Mechanical Engineering PhD student in the team. Mike Miles, a Mechanical Engineering PhD student in the team. Mike Miles, a Mechanical Engineering PhD student in the team.
MODERN WILDFIRES REQUIRE LARGE-SCALE SOLUTIONS

As wildfires in Boulder and in the West continue to worsen, the Global Supertanker is a much needed technology.

JUSTIN WANG

Two weeks after finishing her wildland firefighting training with the Boulder Emergency Squad, Aerospace Engineering Master’s student Rydell Stottlemyer was called to the scene of the Calwood Fire on Saturday, October 17, 2020.

On that Saturday morning, she was in drone training when she and her team heard on the radio about a new fire breaking out in Boulder County. “We ended up being one of the first departments on scene,” said Stottlemyer.

Once people evacuated and they evaluated the scale of the fire, Stottlemyer helped create a “fire line,” which entails removing any flammable objects, such as trees and brush, to prevent the fire from spreading further. However, the fire moved faster than the firefighters could maintain with the flames spreading an average of 1,500 acres per hour.

In wildland firefighting, it is tremendously difficult and dangerous to work against the “flame front,” which is the direction the fire predominantly moves. Instead, a safe anchor point is established where firefighters work to develop these fire lines to contain the fire as much as possible. Since cooler temperatures lead to decreased fire activity in the evenings, Stottlemyer worked through the night with her team on the scene. “Several of us spent the night in the Calwood Education Center,” said Stottlemyer. The next day, she went back along the fire line to put out any fires that had the potential to cross it. After spending her weekend in smoke with little sleep, she returned to the University of Colorado Boulder to continue her studies and job as a teaching assistant.

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Leffthand Canyon Fire, which started on October 18, totaled 6.6 million.

“The country spends a lot of money on fighting fires...The last thing they want to do is spend even more money because it goes over budget almost every year.”

“Since wildfires have been prematurely extinguished over the last hundred or so years, modern wildfires are exceptionally harmful. Forest ecosystems evolved with periodic wildfires that would naturally thin forests. By preventing them in the past, the amount of vegetation that can fuel wildfires has significantly increased. Increased drought and a warming climate have contributed to making wildfires so large that they cause irreparable damage to these forest ecosystems. As wildfires become larger and more frequent, it is apparent that new technological developments are required to deal with them,” said Parsons. "Airplanes that carry water are a handle on these fires that are bound to come."

"I also think it’s important to keep hiring these contractors that come up with new technologies,” said Parsons. "New technology makes it safer. The better the technology, the safer it is for us, and the more efficient we can be at mitigating these fires.”

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The Global Supertanker is a Boeing 747-400 Very Large Airtanker (VLAT) aircraft that is capable of dropping nearly 19,000 gallons of water or fire retardant to fight wildfires. This vehicle can fill its 10 liquid tanks in less than 30 minutes, and it utilizes eight high pressure and two low pressure air tanks to release its cargo from low as 200 feet above the surface. It is the largest VLAT ever created and can hold nearly twice as much cargo as the second largest VLAT used for wildfire suppression.

"In the beginning, we would often see comments from around the world on social media saying, ‘they’ll learn you can’t fly a 747 in low altitude mountainous environments effectively. We proved them wrong through hundreds of hours of test flights and training flights, and we wrote the book on operating the 747 as an effective firefighting tanker,” said Parsons.

"Still, when looking at fires in the West, it is apparent that there needs to be more investment into advancing technology both to prevent wildfires and to help fight them. "There is no doubt that the planet is warming,” said Parsons. "Every year we are burning more acreage with bigger fires. As long as there are people building and living in the forests, we don’t have the luxury to let these big fires burn. I think it’s important to invest in new technology and get a handle on these fires that are bound to come."

“Parsons emphasized that an ‘initial attack’ is required, which involves fighting fires when they are first detected rather than waiting for them to grow larger. "The sooner we can get a handle on these fires, the better,” he said. "The better the technology, the safer it is for us, and the more efficient we can be at mitigating these fires.”

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then waiting to see how they develop. When initial attack fires aren’t contained or controlled, they become “extended attack fires” that are often more damaging and costly. Parsons argued that “In a perfect world, it’s healthy to let forests burn, but we don’t live in that world anymore. With the planet warming, more people building and living in forests, poor land management for over a hundred years, and various other factors, we need to hit these fires early and hard.”

A study by Dr. Stephen Fuller and Dr. Keith Watters at George Mason University (GMU) supports this notion. This study utilised U.S. Forest Service data to conclude that deployment of air tankers, like the Global Supertanker, early in the life of wildfires dramatically reduces fire duration and the resulting economic impact. It is challenging, however, to implement these results. Parsons said, “It’s a difficult problem when the fire is small and management orders a VLAT instead of letting it grow, because often becomes expensive and destruc
tive extended attack fires.”

Global Supertanker, the world’s largest air tanker ever created for fighting wildfires, was retired in April 2021 due to financial difficulties. The aircraft was then sold and converted into a cargo aircraft. Nevertheless, a new investor purchased Global Supertanker Services, and at the time of this writing there is talk of modifying another 747 with technology from the Global Supertanker for the 2022 wildfire season.

In addition to air tankers, innovations in wildfire technology have included developing new fire retardants and using infrared radiation detectors on drones, aircraft and satellites that search for heat signals to help detect and monitor wildfires. Nevertheless, more needs to be invested in order to prevent and fight wildfires. Another study from GMU reported that wildfires cost a minimum of $189 billion annually in the United States, and the cost will likely keep rising due to the increasing occurrences of wildfires unless thorough and systematic changes are made. To save over $100 million a year, the state of California utilizes up to 1,000 prison inmates a year to fight wildfires on pay ranging between $1 to $5 a day and an additional $1 to $2 an hour when on a fire line. The ethics of this practice have been debated since the program started in 1940. Another debated practice is that the majority of wildland firefighters are not provided with ample protection for their eyes or ankles. Indoor firefighting personal protective equipment (PPE) is too heavy to take to the scene of a wildfire and typical face masks, such as a N95, and respirators aren’t very effective at filtering out wildfire gases.

“The basics of firefighting are still what they were about 50 years ago, and there’s been limited technological improvement,” said Stottlemyer. It is exceptionally challenging to meet a growing problem when technologies to combat them have not matured in tandem. Wildfires are getting worse and more expensive. As this problem grows, so too does the need for new innovations to make fighting wildfires more effective, economical and safe. This increasing disparity between growing challenges and stagnant technology indicates that more must be done if we are to truly tackle all aspects of wildland firefighting head on.

Members of the Sounding Rocket Lab work together to reach outer space.
In a deal with Xcel Energy, the City of Boulder hopes to minimize its carbon footprint through increased utilization of renewable energy.

HANNAH SANDERS | PHOTO BY ELLIOT WHITEHEAD

The City of Boulder is seen as a leader in sustainability, but as the window for climate change action narrows, citizens are looking to hold large companies and institutions accountable for reducing fossil fuel consumption. After a franchise agreement approved this year between the City of Boulder and Xcel Energy, the transition to renewable energy is now in the hands of Xcel Energy. Under this franchise agreement, Xcel pledged to reduce carbon emissions by 80% by 2030. This sustainability goal was adopted after a decade of advocacy. In 2010, Boulder residents felt that Xcel Energy was not reducing its reliance on fossil fuels fast enough to be consistent with the City of Boulder’s goal to transition away from fossil fuels. In response, voters created the Boulder Power Municipality (a publicly owned energy utility) intended to be the energy utility for the city. In creating the Boulder Power Municipality, voters believed that there would be greater accountability for transitioning to renewables, particularly because a public utility would only serve the local residents.

The Boulder Power Municipality was an appropriate solution, but implementing it proved unrealistic. Taxpayers raised $29 million in funding for the power utility. These funds went towards buying lines, poles, transformers, and other essential infrastructure needed to provide power to Boulder residents. Despite the original goal to be operational in 2017, the municipality never became functional. With no end in sight for when the municipality would be able to provide reliable energy, a ballot measure asking residents to raise the tax to continue the project seemed out of the question. This lack of funding, on top of the financial impact of the coronavirus pandemic, exacerbated the pressure to drop the municipality fight in favor of a deal with Xcel. Moreover, the original concerns that the private utility was not on track with Boulder’s energy goals are no longer as applicable.

The fact of the matter is that Xcel is going to be green long before the City of Boulder. Boulder just does not have the resources to become 100% renewable like they dreamed... it’s just not going to happen independently, but ‘Xcel can do it’,” said Energy Manager with Facilities Management at CU Ellen Edwards.

While some advocates saw the end of the municipality as a loss, the franchise agreement with Xcel provides a pathway for the City of Boulder and the University of Colorado to still reach its “green” energy goals. As of 2020, only 2% of all energy supply on campus came from renewable sources, with Xcel providing the rest. If Xcel could significantly increase its reliance on renewables, the campus reliance on fossil fuels would decrease substantially.

As a state entity, the University also has a lack of funding and land, which prevent campus from becoming completely renewable. Many other large institutions, particularly Universities, get around these restraints by purchasing renewable energy from third party sources in the form of Renewable Energy Certificates (REC), a similar process to buying carbon offsets. CU Facilities Management, however, has opted for a different strategy.

Institutions that purchase RECs pay for electricity generated from a renewable energy source across the country. The kilowatt hours of renewable energy are sold on the market for the renewable credits. While purchasing RECs means that renewable energy is being used somewhere, the process does not support local energy supply and also introduces questions of efficiency and accountability. For example, a main criticism of RECs is that they allow institutions to claim to be renewable, a claim institutions often hide behind instead of tackling other areas where sustainability can be improved.

“We don’t want to buy energy from third parties to claim that we’re green. We would rather work harder at conserving energy, lowering our load on campus, and supplementing with as much renewable energy as possible.”

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Ben Capeloto, a leader on CU's campus

Ben Capeloto uses his position on CU student government to create a more inclusive and diverse culture.

A. TANVIR | PHOTO COURTESY OF BEN CAPELOTO

Ben Capeloto

Do you have any hobbies? Programming, hiking, camping and fly fishing.

What book are you reading?

One Giant Leap: The Impossible Mission That Flew Us To The Moon by Charles Fishman

What areas of aerospace interest you the most?

Space domain, planetary explorations, and space situational awareness.

Would you consider running for office?

I can’t plan that far out in the future. If anything happens in that regard, I’d like it to go in a similar way then what happened to astronaut, and now senator, Mark Kelly.

Is there anything you would like to say to the students?

Thanks for coming back to the semester in person after a difficult year. It’s great to see students back on campus, and if anyone has ideas or a passionate disposition to make an impact, come and talk to me.

Ben Capeloto

knew he wanted to become involved as a representative. He felt moved by certain issues like the mental health crisis and lack of diversity on campus. The mental health crisis is an epidemic plaguing college campuses across the country. It was one of the main focal points of Ben’s campaign and has remained a focal point during his administration. According to Ben, “A lot of us on campus do not feel supported, but we are taking steps to make students’ lives better and help fight the mental health crisis. As student leaders we are trying to improve the situation.” Regarding possible solutions for better serving the student community, Ben emphasized that the structure of the Tri-Executive’s not only introduced more democratic decision making at the top of the organization, it also left them with ample space to focus on a broader range of projects which may result in a more efficient distribution of services for CU students.

In an attempt to tackle social issues regarding diversity, equity, and inclusivity of minority students at CU Boulder, CUSG has continued working with the CU Police department. Kayva lone (Chairperson of Tri-Executives) is working on the Police Oversight Board in tandem with other projects. Ben is currently working on reviewing the Colorado Creed. The Colorado Creed is a collective set of guidelines, codes of conduct, and values that students of CU Boulder are expected to uphold. It is not a mandated bylaw, nor is it enforced by any governing body of the college; it is rather a set of rules that encourage students to be accountable, responsible, and upstanding members of the CU Boulder community. Because concerns were raised by several students on campus that the current bylaws are not inclusive enough, Ben began to work on reviewing it. In addition to their array of projects, the Tri-Executive structure allows the new CUSG leaders to represent wider varieties of students; 3 chairs currently represent 3 different majors, 2 minors, 2 different schools, and various states. This allows for new policies to cover an overarching segment of the CU Boulder student population.

Regarding the matter of student government and representation generally, many professors and partners in industry recommend that CEAS students try to take on leadership roles that go beyond their coursework and projects. More student involvement can help generate more collaborative student leadership on campus. On an individual level, involvement similar to CUSG prepares engineering students for their post-graduation career either in industry or academia.

Back to the main content
Engineers are too often seen as students who only excel at math and sciences, but these engineering students defy the stereotype.

ARTISTS & ENGINEERS: ONE & THE SAME

1. Ace Stratton: Senior  
   Major: Aerospace Engineering  
   Title: Frustration with the Mundane  
   Medium: Acrylic

2. A. Tanvir: Junior  
   Major: Aerospace Engineering  
   Medium: 35mm Analog Photograph

3. Nora Drewno: Senior  
   Major: Mechanical Engineering  
   Medium: Digital Photograph

4. Jessica Clarke: Senior  
   Major: Information Science  
   Title: Mountain Galaxy  
   Medium: Acrylic on Canvas

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Two thousand years before the birth of modern science, Socrates argued that the person who was best equipped to cure a disease was also most capable of spreading one, and so began a conversation still under way: How can the increasingly vast powers of science be guided toward the solution of human problems and kept from aggravating them?

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