

HELLO WORLD

Computer Engineering | Cal Poly College of Engineering | Winter 2022

CPE Becomes a Department



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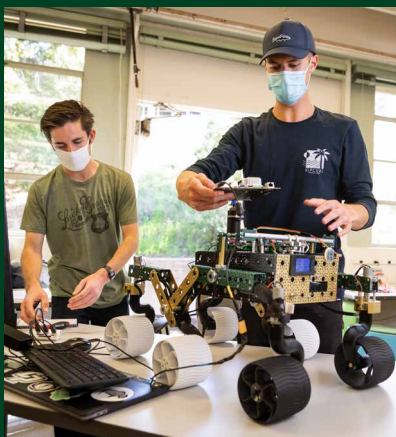
Computer Engineering
COLLEGE OF ENGINEERING

HELLO WORLD

Using technology to help people.



Cover photograph



BUILDING A MARS ROVER

In engineering lecturer Rich Murray's Capstone Computer Engineering Project Lab class, CPE students work on a prototype JPL open source Mars rover among other projects.

CONNECTING UNDERSERVED COMMUNITIES

Computer engineering alumna Jen Overgaag, right, is currently a project engineer for Invenio, which brings information and communication technology to remote communities around the world. See story on Page 8.

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NOTE FROM THE CHAIR



The first meeting of the Cal Poly Computer Engineering Department was held out on the Cal Poly Research Pier.

As some of you know, the computer engineering program is now a department – a move that grants us greater autonomy and the flexibility to better respond to our rapidly changing industry.

We realize that there will be some questions about how that will impact us, so we have offered some answers in this newsletter. In short, this development represents excellent



Lynne Slivovsky

news, allowing us to better respond to needs by having more control over hiring, policies, our vision and more while also providing students with a greater sense of identity.

For our industry friends, this will provide more sponsorship opportunities, including lab naming possibilities. And we can more clearly identify some of the areas we seek to support.

Right now, for instance, we're seeking support for our senior capstone projects, laboratory renovations and student lab kits. Capstone projects are multidisciplinary opportunities with real-world applications, where students use the latest technologies and work with both industry members and faculty advisors. Keeping our labs and lab equipment current is vital to pursuing the Cal Poly Learn by Doing approach that gives our students an edge.

And, of course, we will seek support for our goal of promoting diversity, equity and inclusiveness. As a university that receives state funding, it's paramount that our students reflect the state's diverse demographics. And we know the diversity of ideas promotes greater innovation.

I'm honored to have been named the department's first

chair, and I look forward to making this transition work as effortlessly as possible. Yet, I also want to thank all of those who helped us through this process for your hard work, dedication and patience. The CPE Department is now its own entity, and that will be even more obvious now that we have a stronger identity and greater independence.

Computer engineering student Regina Chapuis is one of many standouts in the computer engineering student body. As you'll see in her profile, she became a CPE student because she specifically liked seeing tangible results that computers can produce. For that reason, she has been a long-time member of the Cal Poly Rose Float team, serving this year as team president.

Computer engineering alumnus Jen Overgaag traveled the world seeking tangible results that have a societal impact. Her quest to make a difference prompted her to quit her job with Cisco, a popular destination for tech grads. And, as you'll see, she really has had a positive influence in different parts of the world.

And, of course, this fall marked the full return to in-person learning on campus. Computer engineering thrives on physical, hands-on work, but it's also beneficial to take advantage of virtual technology. For several years, I've worked to incorporate my passion for diving with STEM learning. And, as you'll see here, we've combined the physical aspect of teaching marine science – exploring the ocean – with the virtual, using the tools of technology to live stream lessons to children.

We're happy to bring you these stories, and we hope we have explained the department transition well enough. But if you have any questions, please don't hesitate to reach out to us. Meanwhile, stay healthy and have a wonderful 2022! ■



A GREATER SENSE OF IDENTITY

In engineering lecturer Rich Murray's Capstone Computer Engineering Project Lab class, students engage with real-world clients in the process of understanding customer needs and developing solutions to meet those needs.

Cal Poly's Computer engineering program becomes a department with the goal of being better suited to adapt to industry and connect with alumni

For incoming students, the computer engineering program's transformation to department status was visually evident even before fall classes began, when more CPE faculty were available during Week of Welcome events. And as the school year continues, those students will likely notice more changes, which are expected to help develop a greater sense of identity while allowing the department a greater ability to adapt to rapid industry changes.

"Starting a department is a rare opportunity," said Lynne Slivovsky, the former program director, who is now serving as department chair. "Some people would say it's been a long time coming."

The computer engineering (CPE) program was created in 1988, under the umbrella of two departments: Electrical Engineering (EE) and Computer Science and Software Engineering (CSSE)

"Thirty years ago, when the program started, it was a very new field, and there were computer engineering degrees popping up around the country," Slivovsky

said. “But the field has evolved, as has the program.”

Today, there are roughly 500 students in the new department, which was recently ranked second in the nation by the U.S. News & World Report.

“The reputation of our computer engineering degree is outstanding,” said College of Engineering Dean Amy S. Fleischer. “However, because the industry is expanding so quickly, we need to make curriculum innovation easier so we can continue to lead.”

As a program, computer engineering had to navigate multiple departments and three curriculum committees for decisions related to policies, hirings, scheduling and courses.

“There was definitely an issue around identity and a sense of belonging,” Slivovsky said.

The process of transforming CPE to a department included faculty and staff from CPE as well as the EE and CSSE departments, open forums with an outside moderator, department discussions at retreats, a 6-month working group facilitated by an outside moderator and a follow-on task force.

Leadership in the EE and CPE departments both supported the decision, made by Fleischer, to make CPE a department. It was also endorsed by Provost Cynthia Jackson-Elmoore and the Provost-Deans Council and approved the Academic Senate. Meanwhile, a detailed vision of the department was created by a department formation task force — a vision that will be more easily achieved with greater autonomy.

“They have developed a clear and compelling vision in which the Computer Engineering Department is a place where all understand and value computer engineering as being more than a sum of the traditional fields from which it grew, championing collaboration, inclusivity and equity in the field while offering a dynamic and agile curriculum that reflects the ever-changing nature of the field,” Fleischer said.

As a result of the change, now CPE will have dedicated faculty, whereas previously all CPE faculty also worked in either the EE or CSSE departments. As part of the transition, eight faculty members changed their

tenure home from EE or CSSE to CPE.

“It’s really all about having a dedicated group of faculty for this group of students and being able to adapt to changes in the industry,” Slivovsky said.

John Oliver, a CPE faculty member who was program chair when the move to department status began in 2018, said some of the biggest changes in the industry in recent years have included artificial intelligence and security.

“When I started in 2007, there were computer viruses, but these were mostly a novelty,” he said. “Now that computer security breaches have been monetized, there is rarely a day where computer security is not in the news.”

When he began, Oliver added, artificial intelligence was more of an academic pursuit.

“Industry has now taken to using AI for a wide array of solutions,” he said. “Under the old CPE structure, I don’t think these are topics we could have tried to move into because we had to also satisfy the EE Department. Now that we have more autonomy, CPE must become more resourceful in making sure that faculty stay up to date on new developments.”

The change will also help the other two departments, said Dale Dolan, interim co-chair of the Electrical Engineering Department.

“A new, vibrant CPE Department will create space for innovation, research and collaboration,” he said. “This can also be seen as a positive for the EE Department in that it will allow for EE to develop and create its own future on new directions in the electrical engineering field.”

The move is also expected to improve student engagement after graduation and improve industry support. With a clear vision, greater sense of identity, dedicated labs and research space, Slivovsky said, it will be easier request support from industry. Specifically, she hopes industry will support labs, projects, initiatives related to Justice, Equity, Diversity and Inclusion, and the Summer Undergraduate Research Program.

“All of these things will provide our students with a better educational experience,” she said. ■

“Industry has now taken to using AI for a wide array of solutions. Under the old CPE structure, I don’t think these are topics we could have tried to move into because we had to also satisfy the EE Department. Now that we have more autonomy, CPE must become more resourceful in making sure that faculty stay up to date on new developments.”

John Oliver,
former CPE Program Director

HELLO WORLD

Computer engineering students used a Jupyter notebook to map tree crowns and count the number of trees as well as timber estimates before and after the August 2020 fire at Cal Poly's Swanton Pacific Ranch.

A PRODUCTIVE SUMMER

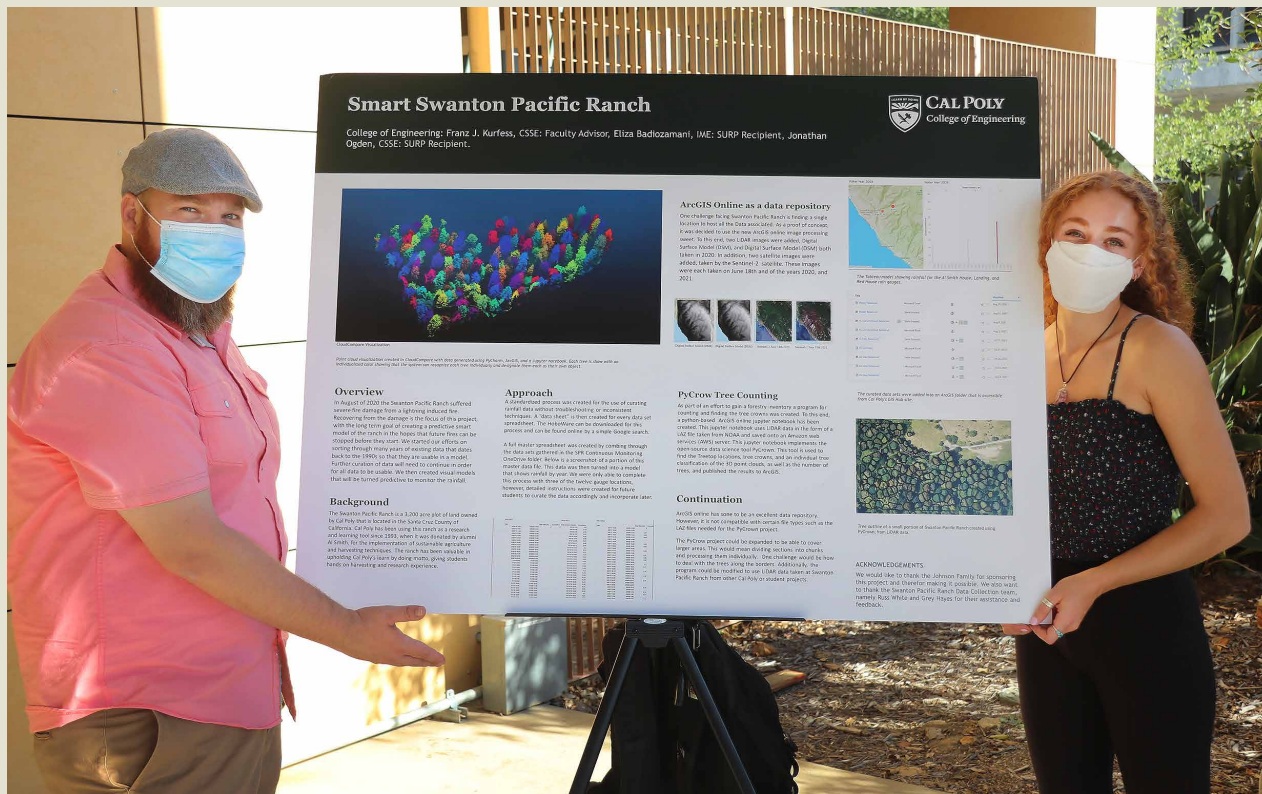
Computer engineering students gained valuable experience in the Summer Undergraduate Research Program



Gaining valuable experience over the summer, three teams of computer engineering students worked to predict future wildfire risk at an important Cal Poly property, improve 3D printing and support search and rescue missions.

The Summer Undergraduate Research Program they participated in pairs newer undergraduates with faculty mentors to work on projects, often sponsored by industry, that entail relevant research over an 8-week span. At the end of the program, students present their work at the annual SURP Symposium. Some of the projects continue beyond the summer.

After the Swanton Pacific Ranch, seen here, was badly damaged in a 2020 fire sparked by lightning, students conducted research to predict future rainfall while procuring data on trees and timber at the 3,200-acre property, which Cal Poly has used for research and education since 1993.



Computer engineering students Jonathan Ogden and industrial engineering student Eliza Badiozamani began data curation and started the modeling of Cal Poly's Swanton Pacific Ranch. The project involved creating master data sheets compiling past data collection efforts from the Ranch's weather systems, and then modeling these figures in an interactive map of rainfall patterns by year, from 1998 to 2019. Below: fire devastated the ranch in August of 2020.

This year, computer engineering students were involved in three projects:

- **Smart Swanton Pacific Ranch.** CPE student Jonathan Ogden teamed with industrial and manufacturing engineering student Eliza Badiozamani to begin data curation and modeling of Cal Poly's Swanton Pacific Ranch. The 3,200-acre property in Santa Cruz County, used for research and learning since 1993, was badly damaged by a wildfire in 2020. The SURP project created visual models that will be turned predictive to monitor the rainfall. The project also created a Jupyter notebook to count the number of trees and timber estimates before and after the fire. Franz Kurfess served as faculty mentor for the project, sponsored by the Johnson family. There is a group of five CPE students continuing to work on this project in 2022 alongside librarian Jeannine Scaramozzino.

- **Computer Architecture Approaches for 3D Printing.** While 3D printing has evolved vastly in recent years, there is interest in exploring fabrication at higher resolutions. CPE students Quentin Monasterial and William Terlinden worked with faculty mentor Joseph Callenes-Sloan to explore efficient 3D printing organizations to meet the demands of the emerging applications. The project,



sponsored by Northrop Grumman, used traditional computer architecture approaches to redesign a 3D printing stack with the goal of optimizing slicer and print times.

- **AI for Search and Rescue.** Gary Bloom, a Cal Poly alumnus (Computer Science, '82), who has been involved in search and rescue missions since he was an engineering student, sponsored the project and worked with the team, which included CPE student

Meha Sharma and computer science partners Siddarth Viswanathan and Ritvik Seshadri. Kurfess, Lynne Slivovsky and Maria Pantoja served as mentors on the project, which created web versions of paper documents used in search and rescue missions. The project has continued in CPE and CSC courses, incorporating artificial intelligence and a mobile app. ■

POSITIVE TECHNOLOGY

CPE alumna Jen Overgaag traveled the world and found her calling

Three years after graduating from Cal Poly, Jen Overgaag quit her job at Cisco Systems and embarked on an international backpacking trip that would change her life.

"I am deeply grateful for my time at Cisco — it truly set me up for success in my career by giving me access to an incredible amount of training and field experience," she said. "As time went on, I realized that the work I was doing was not having an impact on the people in the world who needed the most help and whom I most wanted to help."

Years earlier, her journey began in a much different setting — an "extremely small town" in Wyoming, where computer classes were limited to independent study.

"The teacher in this class noticed that I had a gift for technical work and suggested that I look into studying in a computing field," she said.

She eventually went to Cal Poly, graduating with a computer engineering degree in 2006. After college, she landed a job as a systems engineer at Cisco, a desirable landing for tech grads. But, as Cisco provided her with valuable career tools, she began to reconsider her goals. Unsure what type of career would best position her to help others, she left the country for 18 months, stopping in Western Europe, Eastern Europe and, as her savings began to dwindle, Africa.

"I eventually ended up volunteering with a school in Zambia when someone in my network heard about my career goals and connected me with the principal at the school," she said. "It was during my time at this school that I realized how I could use my skills and education to make a huge difference in people's lives."

While working as a technology volunteer, she noticed that students with internet access were more engaged with their education and had more ambitious education goals.

"This is how I realized the power that technology has to drive development in some areas of the world," she said. "I came back to the U.S. with a goal to find an organization that was focused on using technology to provide access to information which in turn would help drive development."

Once she returned to the United States, she became a project engineer with Inveneo, whose mission is to get the tools of information communications technology — such as computers, phones, and internet access — to people and organizations in rural and highly underserved communities of the developing world. Two years later, she founded BANJO Networks, a consulting business that specializes in rapid communications network deployment in response to disasters and sustainable technology solutions in diverse



Climbing towers in rural areas is part of the job for CPE alumnus Jen Overgaag, a project engineer for Inveneo, which brings information and communication technology to underserved communities around the world.

and challenging environments. In that role, she spent considerable time in Haiti, which suffered a devastating earthquake, the typhoon-stricken Philippines, and Puerto Rico after Hurricane Maria.

After a disaster, Overgaag said, communications are needed for hospitals, municipalities, and police; non-governmental organizations trying to provide relief; and families attempting to connect with loved ones.

As she helped facilitate those communications, reactions to disasters — neighbors helping neighbors get food and water, clearing streets for supply trucks or helping each other find relatives — offered a renewed sense of faith in humanity.

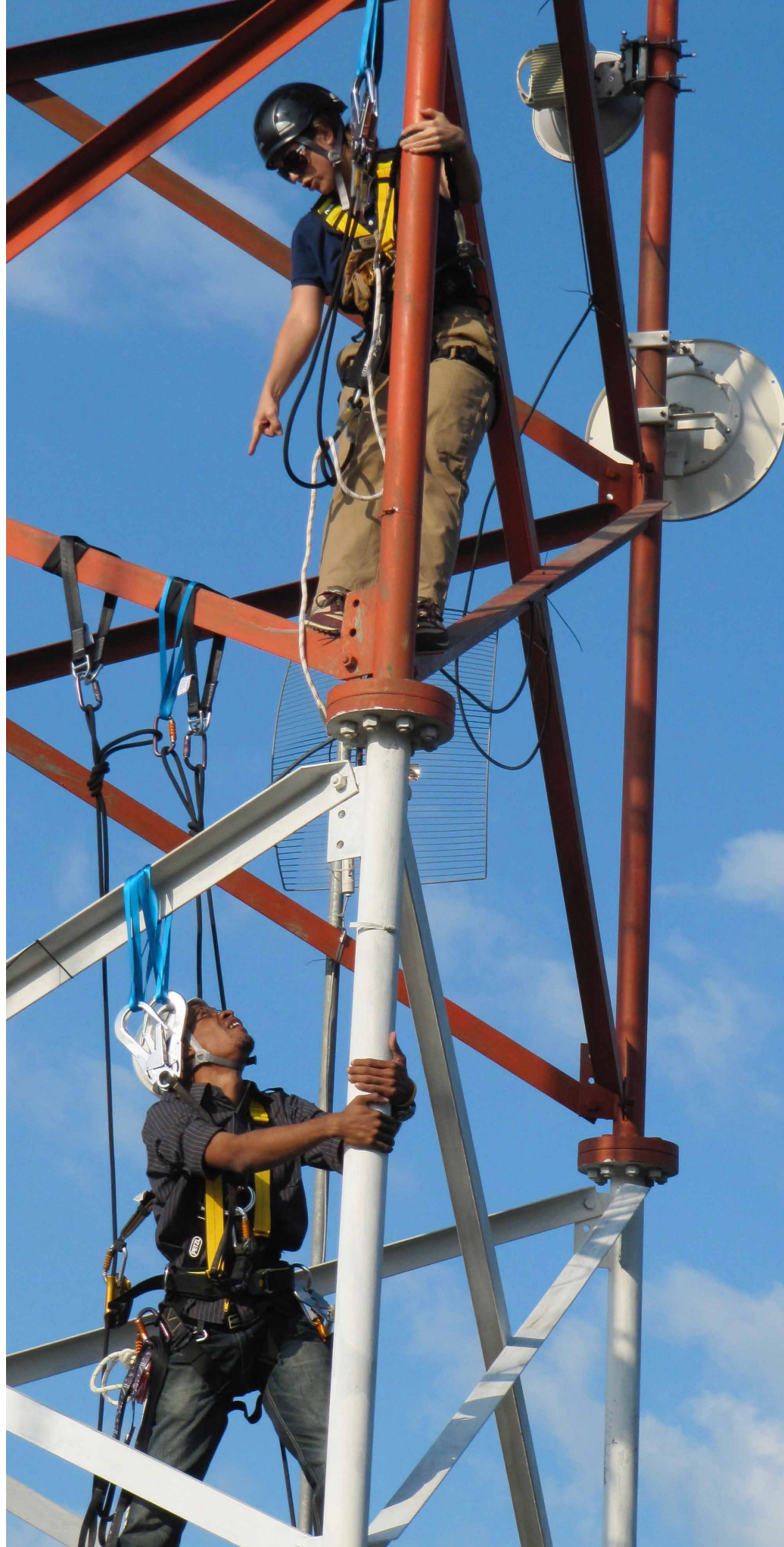
“Aside from the obvious grief, chaos and destruction, the sense of community is what I have noticed stands out the most in the environment following a disaster,” she said. “I am constantly impressed at how people show up for their community.”


Overgaag, who volunteers on the Computer Engineering Industry Advisory Board, still assists communities through BANJO Networks. And since September 2020, she has worked as a software engineer for Recidiviz, a nonprofit focused on accelerating progress toward a smaller, more fair criminal justice system.

“We use data shared with us from the departments of corrections within our partner states,” she said. “This data allows us to provide open-source tools for real-time monitoring and analysis, standardizing metrics across national, state and local jurisdictions, and create tools that enable outcome-based decision making.”

A dancer and “creative reuse” artist, Overgaag also promotes creative thinking with tech. While disinformation campaigns have cast a shadow on social media platforms, Overgaag thinks tech’s overall impact on society is positive — whether it’s addressing wider challenges, such as climate change, or smaller ones that impact a handful of people.

“Change can be messy, and we are in the middle of a digital revolution,” she said. “I have very high hopes that on the other side of this revolution, we will be a more just, equitable, healthy, and sustainable society.” ■





TAKING THE PARADE ROUTE

CPE Student Regina Chapuis Leads the Cal Poly Rose Float Team in the 2022 Parade

During a club fair her freshman year, Regina Chapuis made eye contact with someone working the Rose Float booth and felt compelled to stop and talk. She eventually offered her email address, but she didn't plan to pursue an invitation to attend the next club meeting.

And yet she did — and never missed one afterward.

"I really just love the community of people I encountered the first day I came out," she said. "They were such a tight-knit group of people that were doing this massive building project, and I saw that and said, 'I want to be a part of that!'"

Today, the computer engineering senior is the president of Cal Poly's Rose Float,

which won the Animation Award for its Stargazers float during the annual Tournament of Roses Parade on New Year's Day.

The parade has notably been a popular TV event for those in the Midwest and East fantasizing about an escape from their frigid winters. Yet, Chapuis, who grew up in Sacramento, wasn't that familiar with it.

"A lot of people come to the Rose Float program because they have grown up with the Rose Parade — that's something they watched on New Year's," she said. "I did not really know what the Rose Float was when I came to college. I was looking for something that fused art and engineering."

Born to parents with careers in TV news and public relations, her interest in

computer engineering began in the fifth grade, when a friend introduced her to the learning the software Scratch, a visual programming language and website targeted at children 8-16.

"That's when I fell in love with coding," she said.

She also had an interest in art and animals. In high school and part of college, she worked as a teaching assistant and camp counselor at the Sacramento Zoo.

"At the Sacramento Zoo, my favorite animal is the red river hog," she said. "I think they're really pretty, and also the babies that were born a few years back are all named after Star Wars characters, which I think is cool."

After high school, Chapuis gravitated

"It's about the power of education, so clearly that is very important to us as the only student-built float."

— Regina Chapuis on the 2022 Rose Parade theme: Dream. Believe. Achieve.



Built by students at Cal Poly and Cal Poly Pomona, Stargrazers cruises down Colorado Boulevard in Pasadena during the 2022 Rose Parade. At left, computer engineering student Regina Chapuis, left, displays a football tribute made for Cal Poly alumnus John Madden, the NFL Hall of Fame member who passed away in December. Cal Poly President Jeffrey D. Armstrong is at right. (Photos by Tom Zasadzinski, Cal Poly Pomona)

toward computer programming because she wanted to work with the intersection of software and hardware.

"I find those projects with a tangible end product to be really fun," she said.

Likewise, the Rose Float team allowed her to see the results of her work — in a big way.

The Cal Poly Universities float — a joint project with Cal Poly Pomona — is the only student-built float in the parade, which is

team transports its half of the float to Pomona, where both teams work to complete the project.

This year's parade theme was "Dream. Believe. Achieve."

"It's about the power of education, so clearly that is very important to us as the only student-built float," she said.

Stargrazers brought to life a scene from the Mother Goose nursery rhyme "Hey Diddle, Diddle." It featured a 600-pound

seen by 70 million viewers worldwide.

Chapuis held multiple leadership roles before becoming president. In the president role, her duties include promoting communication between departments, heading team events and facilitating the trip to Pomona.

In October, Cal Poly's

cow jumping over a 15-foot moon with the aid of jet packs, other nursery rhyme characters and multiple animations.

"Something I'm really excited about is there is a mechanism — we call it 'flowing deco mech,'" she said before the parade. "One of the test jet packs has these clear tubs with an air blower that sort of flows like a tornado in the tube that we're going to put dried deco in, like dried flower petals, and have them flutter around."

Beginning in October, she and the team began traveling to Pomona every weekend, leading to a final full-time hectic push in the three weeks before the parade. On Jan. 1, most of the team watched from the crowd as the float rolled down Colorado Boulevard.

"It's high stress, and you're keyed up and on task all week," she said. "And once it's finally over, you lose that adrenaline rush. But it's also very gratifying." ■

DIVING INTO A NEW ROLE

Lynne Slivovsky is the choice to be computer engineering's first chair

Whenever Lynne Slivovsky dives at the Cal Poly Pier, she might be able to see as little as a few inches in front of her or as far out as 30 feet.

"There's a lot of stuff that affects the visibility out there," she said. "But when it's clear, it's really spectacular."

Since the computer engineering program became a department, Slivovsky now has a much clearer vision for CPE students, faculty and staff.

"It's an amazing vision," she said. "And by being a department, we get the opportunity to actually make that happen."

As the department's first chair, Slivovsky has played a significant role in creating that vision.

"Lynne has been great," said John Oliver, who was program director when the movement to become a department began. "I got to 'break' things. As we know it's a far harder job to build things."

Raised on the East Coast, Slivovsky might not have ever become CPE chair had she taken her engineering skills in another direction.

"I was originally thinking it might lead to med school," she said.

But the dual computer and electrical engineering major at Purdue University eventually gravitated more toward computer engineering. It was at Purdue in the early 90s that she began her underwater hobby, diving in Indiana quarries and during vacations in Hawaii.

Once a prospective surgeon, Slivovsky earned her engineering Ph.D. from Purdue and joined Cal Poly's faculty in 2003. Since that time, she has witnessed the university make greater efforts to encourage diversity and inclusion — an important initiative for her and one of the stated goals of the new department.

"Looking forward, I really want it to be about students feeling like they belong here and have the support structures in place to help them when necessary," she said.

Slivovsky is also interested in combining disciplines. Relocating to the Central



Lynne Slivovsky, chair of the Cal Poly Computer Engineering Department is an avid scuba diver and mountain biker, here taking a selfie during a Hike-a-Bike through snow at Red Meadow Pass in Montana.

"Looking forward, I really want it to be about students feeling like they belong here and have the support structures in place to help them when necessary."

Lynne Slivovsky | CPE Chair

Coast opened up more opportunities for her diving hobby. And, roughly a decade ago, she began looking for ways to incorporate education into her diving.

"I really wanted to combine the work I was doing in computer engineering with marine science," she said.

One recent initiative, a joint effort with the Biology Department, offers live streaming marine science lessons to middle school students in a program called Dive Beneath the Surface.

"We'll dive at the Cal Poly pier, and we have a camera with underwater housing, and that is tethered to the surface with a video cable," said Slivovsky, who leads the program with marine sciences professor Crow White. "We merge the video and audio from the divers on the surface and then stream those lessons to YouTube so teachers can bring them up in the classrooms or students can bring them up on their phones, and they can ask questions of the divers conducting the lesson underwater."

The lessons require a team — usually four divers underwater and a team above the surface. While the team above water relays questions and ensures connections are working, divers have to multi-task, navigating currents and other conditions while offering a lesson as students ask questions about what they see on the camera.

"There's a lot more you're paying attention to," she said.

Around the time she began to combine her passions for education and diving, Slivovsky achieved a completely different goal, breaking a U.S. women's weightlifting record for deadlift in 2013.

She had been working out with her

friend Maria Dwyer when Dwyer suggested they aim for the International Powerlifting Championships. They both qualified, and Slivovsky broke the record — 292 pounds — in Las Vegas, breaking the previous mark by five pounds.

Now her competitive instincts have taken her to ultra endurance races with mountain biking.

Sometimes referred to as "bikepacking," ultra endurance races are often a multi-day event that requires the rider to complete



Slivovsky, shown here diving off of Vancouver Island, British Columbia, joins other faculty and students exploring the water around the Cal Poly Pier in Avila Beach while working with the Dive Beneath the Surface project that live-streams undersea video and audio for middle school students.

the entire route, navigating, finding food and places to sleep unassisted.

"In the races it's a combination of physical, mental and emotional challenges," she said. "It's intense navigating the route as well as getting through water, finding places to sleep and camping."

Of course, her biggest challenge now is making sure the new department succeeds. Equipped with a detailed plan, greater autonomy, and a clear vision, Slivovsky is excited to dive into it the new role.

"There are things we can do now as a department that we didn't do before." ■

Behind the Scenes: Beneath the Surface

In videos for Cal Poly's Dive Beneath the Surface project, a jellyfish floats near the Cal Poly Pier, which is covered with sea life, including orange starfish. Meanwhile, divers can be seen exploring the pier, bubbles rising from their head to the water's surface.

But when divers are underwater, it's not always easy to see — or navigate.

"It's kind of weightless," said Lynne Slivovsky, who has been diving for nearly three decades. "You feel the current or the swell around you, depending on the conditions. Sometimes it's pretty dark, so you don't necessarily have a big picture of where you are under the pier."

Dive Beneath the Surface, a project she leads with

biology professor Crow White, helps provide a picture of what life is like under the ocean to middle school students. The project streams live for classrooms and allows divers to interact with students in real time.

Like astronauts connected virtually from space, the divers can be both heard and seen as they float about. Meanwhile, students and teachers can type comments. Recent ones have included, "I just saw a crab and sea urchin too!" "Is it squishy?" and "Are shark sightings common in that area?"

The program is intended to foster an appreciation of marine science, but it requires a lot of technical expertise to pull off.

"We usually have four people underwater, and they have full face masks on, and then we have a team on the surface relaying

commands to the divers," Slivovsky said.

"We've got someone on the laptop merging the audio and video and streaming that out and keeping tabs on what's going on in the chat — the questions from students or teachers — and usually a couple of other people for support, so it's pretty involved. I think we've had up to eight or ten giving this lesson."

To bring their knowledge of marine biology to life in the classroom, the research team had to get certified in scientific diving, learn underwater videography and video editing, and find out how middle school students learn.

"Hopefully, we will inspire some future marine scientists," said biology student Meg Beymer. "This project made me realize I am meant to be an educator, and I look forward to creating Learn by Doing projects like this one for my future students."

While many might not associate computer engineering with oceanic diving, Slivovsky said it's just one example of how CPE can be used in other disciplines.

"There are certainly a lot of areas where you can apply what you're learning conceptually." ■



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