The TIMEs

Industrial and Manufacturing Engineering • Cal Poly College of Engineering • Winter 2023

Making History

Cal Poly IME alumna helps send off the last 747 — the 'Queen of the Skies'

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The TIMEs

Message from the Chair

I am always eager to share compelling stories about our students, staff, faculty and alumni in our IME Department with the broader community, and this month there is no shortage of impressive accomplishments to highlight.

Our cover story features alumna Susan Chandy (Industrial Engineering, '04) who made history as the manager overseeing production of the last Boeing 747, which rolled out for delivery in January. She credits her engineering education with giving her the technical and leadership abilities needed to achieve success on a global scale.

Our faculty members are pursuing groundbreaking research on topics ranging from social media to smart manufacturing, and our students are benefiting as a result.

Through his research, Professor Puneet Agarwal is aiming to give agencies and social media companies new tools to find and track misinformation so they can make informed decisions on when to use their resources to combat rumors. He also strives to educate his students on becoming responsible users of social media so they can avoid pitfalls of the platforms.

After returning from a three-month sabbatical spent exploring manufacturing facilities, I have shared with the department the innovative ways the industry is implementing smart manufacturing to increase efficiency and even be more environmentally sustainable. Two students now are working on their own smart manufacturing project with a Learn by Doing focus.

I believe the research efforts of all our faculty members add real value to the education of our students.

Beyond research, we are committed to the college's vision for building a diverse, just, equitable and inclusive community which involves diversifying our staff and faculty.

The hiring of Jill Speece, new assistant professor of industrial engineering, adds to a strong group of female role models at Cal Poly and draws a growing representation of women into engineering.

Another notable hire brings alumna Autumn Turner back to campus four years after she graduated. She now is our sole woman working in our manufacturing labs and is encouraging others to follow in her footsteps.

Students are carrying on the tradition of excellence as well, winning contests — including a Cisco intern challenge and inclusive design competition — and publishing research papers recognized internationally.

We honored the achievements of our students during a department event in December to celebrate our latest graduating class. The group included manufacturing engineering student Vanessa Castellanos who is wrapping up her educational journey through Cal Poly after 13 years, inspiring anyone doubting whether they can succeed.

Industrial and Manufacturing Engineering Chair Dan Waldorf, left, joined faculty, staff and friends to celebrate Vanessa Castellanos during the department's ceremony to mark winter commencement. Castellanos graduated after a 13-year journey through Cal Poly.

You can learn more about what's happening in the department through our Instagram @calpolyime and Facebook and LinkedIn sites at Cal Poly IME. You can also reach us at ime@calpoly.edu.

As you stay in touch, please consider the many ways that alumni and friends of the department get involved and support our students. We host professional talks and job information sessions; we look for site visits and other tours; we seek sponsorships for our senior projects and research graduate efforts, and we count on donations that enable student travel, student scholarships, new equipment purchases, and new avenues for student and faculty research.

As our alumni and industry partners tell me, it feels great to give back and help support the next generation of Cal Poly students in their quest to bring Learn by Doing into their careers. We all benefit from the support.

— **Dan Waldorf**
IME Chair

COVER

Cal Poly industrial engineering alumna Susan Chandy worked on the final Boeing 747-8F, which, at left, took off from Paine Field in Everett, Washington, on Feb. 1. (Photo courtesy of Craig Larsen Photography)
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Outstanding Research

Undergraduate students' research published, recognized at international conference

Cal Poly IME students gather at San Luis Marble in Santa Maria. The company is sponsoring Professor Mohamed Awwad's IME 417 class which has produced numerous award-winning research projects. Below is the winning notice for a Cal Poly team that competed in an Australian supply chain and logistics competition.

by Taylor Villanueva

Undergraduate students in Professor Mohamed Awwad's Industrial & Manufacturing Engineering (IME) 417 class are once again being recognized for their exemplary research.

While most students work on submitting their research to industry experts at the graduate level, Awwad's undergraduate students are getting a head start. The students in the supply chain and logistics management course have had the unique opportunity to submit their research to industry experts at conferences around the globe.

Tyler Deis (industrial engineering, '22), Zoe Atkins (industrial engineering, '22), Karshin Gupta (industrial engineering) and Duc-Huy Dam (industrial engineering) co-wrote the paper "Backlog of Container Ships at Los Angeles Ports" and were recognized at the 2022 Australian Conference on Industrial Engineering and Operations Management where they placed first.

"In Professor Awwad's class, we collaborated in a team environment in order to research and propose our solution," said Gupta, a student researcher. "The class was very well structured, and I felt we were able to formulate our paper with proper guidance."

Students gain a different perspective when working on research at the undergraduate level.

"Research publication is an inclusive pedagogical approach," Awwad explained. "The students will continue to learn to work in teams as they usually do in other classes. However, this time, the nature of the teamwork they have to do is a little bit different and might require them to plan and coordinate in different ways."

Although most of Awwad's focus is to help undergraduate students in his IME 417 class publish their research, he has also helped a wide range of undergraduate and graduate students become published. This includes BEACoN (Believe, Educate & Empower, Advocate, Collaborate, Nurture) student researchers and College of Engineering students who participate in the Summer Undergraduate Research Program (SURP).

Awwad wants Cal Poly students to benefit from the experience of having their research critiqued by professionals in the field.

"Students can receive immediate feedback from experts on the work they have done and acquire external validation on their work," Awwad said. "This is more beneficial than submitting a term paper that will only be viewed by the instructor, who would provide limited feedback with almost no chance of improving upon the work or research."

The 2022 Australian Conference on Industrial Engineering and Operations Management was a hybrid event, taking place in person with online access for those who chose to attend virtually.

In addition to the first-place honor, a second group of Awwad's students submitted a paper in the conference, titled "End-to-End Enterprise Visibility Software Packages," which was co-authored by Kiyavash Azim (manufacturing engineering), Samantha Giangreco (manufacturing engineering), William Marquez (manufacturing engineering) and Zack Wagoner (manufacturing engineering).

2022 IEOM Australia Awards

Supply Chain and Logistics Competition

IEOM Society

First Place Winner

ID 393 Backlog of Container Ships at Los Angeles Ports

Tyler Deis, Zoe Atkins, Kashin Gupta, Duc-Huy Dam and Mohamed Awwad, Industrial and Manufacturing Engineering Department, California Polytechnic State University, San Luis Obispo, CA 93407, USA

In May, two teams of undergraduate students and one graduate student guided by Awwad will be recognized at the Institute of Industrial & Systems Engineers (IISE) conference for their research. The titles of the two abstracts that were accepted at the IISE conference are "The Effect of the Russo-Ukrainian War on the Global Energy Supply Chain" and "The Rise in Private Brands: A Supply Chain Perspective."

Students in Awwad's other courses have equally unique hands-on opportunities to expand their industry knowledge. This quarter, San Luis Marble sponsored Awwad's IME 443 course project. Students were able to visit the Santa Maria site for their facilities planning and design course.

Past Publications

At the fifth North American conference on Industrial Engineering and Operations Management in August 2020, Cal Poly students presented five separate papers and placed first, second and third in the supply chain competition.

Awwad's students also had two papers published at the 2020 annual conference of the Institute of Industrial and Systems Engineers and seven papers published at the third International Conference on Industrial and Mechanical Engineering and Operations Management, a virtual conference that was held in Dhaka, Bangladesh, in 2020. ■

RESEARCHING SOCIAL MEDIA

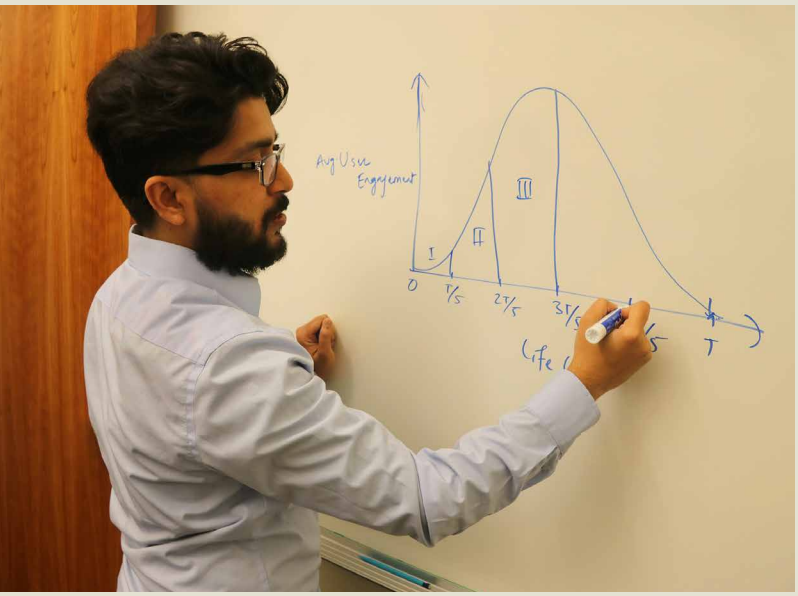
Professor Puneet Agarwal, left, works with engineering management graduate student Jacob Woo on projects involving statistical analysis of social media posts.

Professor's Study Debunks False Rumors on Twitter During Disasters

by Emily Slater

As Hurricane Harvey made its devastating landfall in August 2017, a rumor that ran rampant on Twitter posed extreme danger to Houston's undocumented immigrant community of around 600,000.

The rumor claimed undocumented immigrants could not enter Texas shelters and would be reported to federal immigration agents.



Agarwal, left, charts user engagement on Twitter in relation to seven different false rumors to help social media companies find and track misinformation.

Fearing deportation, many hesitated to access a critical resource that was, in fact, open to all.

During a crisis, millions of people turn to social media to find information and ask questions, but over the last decade a growing number of users have used platforms like Twitter to mistakenly or maliciously spread misinformation.

Industrial Engineering Professor Puneet Agarwal is studying tweets linked to seven different rumors — including Hurricane Harvey — to determine the role verified users play in circulating messages over social media when accurate information is crucial to public safety.

"Verified accounts have a large influence over the spread of information on Twitter and can play a key role in the spread of rumors and misinformation," Agarwal said. "If people with verified accounts are not responsible with their tweets, they can inflict a significant level of damage."

He also wants to give agencies and social media companies new tools to find and track misinformation so they can make informed decisions on when to use their resources to combat rumors.

Mining the Data

Agarwal's project involved collecting more than 500,000 tweets from seven different rumors, including natural disasters, COVID, elections and the war in Ukraine, during a three-year span.

Agarwal used tweets as the basis for his social media projects

Tips for Navigating Social Media

Agarwal has collected valuable insight for social media users during his extensive research.

Primarily, he said, users should take caution when they have an emotional response to a post or tweet.

"If you are getting emotionally agitated, maybe something is wrong," he said. "Take time to do your research and talk to your friends before you react or retweet," Agarwal said.

He also encouraged users to visit fact-checking websites or alternate platforms when looking to verify an assertion.

In addition, users should take caution when digesting information from influencers or others with a large following who may not be making credible claims.

"You shouldn't take life advice from actors or singers," Agarwal said with a smile.

— funded by the National Science Foundation — because Twitter provides easy access to data for researchers, while Facebook and Instagram have more restrictions.

Once collected, the tweets were analyzed through statistical tests, graphs and charts, time series analysis, data mining and machine learning algorithms.

Agarwal's analysis showed that despite making up less than 2.5% of all tweets about rumors, verified accounts are directly responsible for over 50% of the engagement that tweets about rumors receive and indirectly responsible — through retweets — for more than 16%.

"When you are sharing or liking tweets from verified accounts, people will believe you," he said.

The finding that surprised Agarwal the most, however, was that verified accounts' extreme influence on rumor is likely more related to the number of followers they have than the fact their account is verified.

"People actually believe tweets from accounts with a lot of followers whether they are verified or not," Agarwal said.

Machine Learning

Misinformation amplified on social media and other digital platforms can prove particularly dangerous during crisis events, but tracking multiple false rumors can prove daunting to agencies with limited resources.

To aid agencies with monitoring, Agarwal is developing a machine learning framework that can track multiple cases of misinformation and predict the veracity of tweets spread during crisis events.

Machine learning models can be trained to learn which tweets are disseminating false information based on Twitter data collected from earlier disasters where misinformation was spread.

"We can track how many people are engaged with a rumor and spreading false content," Agarwal explained.

Agencies then can make informed decisions about the cases they choose to clarify and the timing of their debunking response.

Reacting too quickly can result in a clarification that is imprecise or incomplete, although waiting too long can allow rumors to spread with their full force while officials construct a more complete response, according to Agarwal.

Decision-making can be challenging, Agarwal said, but metrics can help.

"We now have the tools to understand more about the data coming from social media platforms so we can control the spread of misinformation," he added. ■

To Tweet or Not to Tweet

Master's student researching social media campaigns to find the answer

The power of social media campaigns to affect social change intrigues blended master's student Jacob Woo, who is framing his final research project around the phenomenon.

Woo, in his fifth year of a program to obtain his bachelor's in industrial engineering and master's in engineering management, doesn't regularly use social media outside of TikTok but believes it's an ideal research tool.

"It's a really good way to study people and the world around you," he said. "It's like the world's town square."

Woo's master's project aims to find the factors that matter the most in predicting high engagement with social media posts during a campaign — a coordinated marketing effort on social media designed around one central idea and goal.

Woo chose 12 Twitter campaigns ranging from the political and social to environmental and technological, noting that each had to have a 100,000-tweet minimum. One campaign he's analyzing is the Stop Asian Hate movement, launched in March 2020, to address anti-Asian racism.

"I want to see how social media trends live and die. A good level of curiosity is keeping me going."

— Jacob Woo

"I didn't know a lot about the campaign even though I am part of the community," said Woo, who grew up in San Francisco.

He's looking at three factors for his research: the time of day and time within the total life cycle of the social media campaign; whether the user is verified and/or has a large following; and the content of the tweet, which can be broken into positive or negative sentiments and emotions.

"I want to better predict user engagement to benefit users or the campaign itself," Woo explained.

Campaign organizers can use such data to frame the most impactful message, according to Professor Puneet Agarwal, who is advising Woo on his project.

Now that the data has been collected, Woo is using a series of algorithms to take the tweets and assign a positive, negative or neutral value so he can determine how users are responding and engaging with content.

"The coding has been challenging but I'm learning a lot," he said.

Woo is hoping to gain a better understanding of the best times to tweet and the best times to avoid so campaign organizers can maximize the impact of their messages. He also aims to pinpoint the time a campaign's effectiveness ends.

"I want to see how social media trends live and die," Woo said. "A good level of curiosity is keeping me going."

Woo plans to publish his research before graduating in June and ideally land a job studying social media. ■

Making History

by Emily Slater

Susan Chandy stands with the final Boeing 747 after a special ceremony on Jan. 31. Selfie stations were set up throughout the build for Boeing teams to mark the completion of each phase.

Cal Poly engineering alumna sends off the last 747 — the 'Queen of the Skies'

Susan Chandy did not dream as a Cal Poly freshman in the fall of 2000 that her engineering education would lead to a pivotal role retiring the most famous jumbo jet in the world — the "Queen of the Skies."

She was living on her own for the first time in a new city, adjusting to the fast-paced quarter system and keeping up with a slate of industrial engineering classes in preparation for the desk job she imagined.

Four years later, an offer to work in the Boeing Co.'s fabrication division changed everything.

"I thought I would end up in an office, wearing business suits and high heels, but here I was on the manufacturing floor with boots and safety glasses," said Chandy (Industrial Engineering, '04), recounting her journey from the classroom to the shop floor, then into leadership at one of the world's largest aerospace companies.

Her latest assignment will put her in the history books as the manager overseeing production of the last — or 1,547th — Boeing 747, which was rolled out for delivery in January.

During a final farewell ceremony, thousands paid tribute to the jumbo jet that revolutionized air travel and won a permanent place in American pop culture.

"The 747 shepherded in the jet era for the masses. Travel became more affordable, and the world became more connected," Chandy said. "People remember their first flight on the airplane that still inspires awe, even for me."

Taking a Pass on Potato Chips

Chandy spent her childhood in San Jose, California, growing up in a culture that had certain hopes for those entering the workforce.

"The expectation for me, as an Indian, was that I would become a doctor or engineer," Chandy said.

She ruled out the medical profession after fainting during a frog dissection in her biology class but was drawn to engineering as an innate problem-solver.

"I always liked taking things apart, and I was encouraged by my dad who is an electrical engineer by trade," she said, citing research that shows daughters emboldened by engineering fathers have a higher likelihood of entering the field.

Choosing Cal Poly, Chandy gained an immediate appreciation for her industrial engineering classes, as they allowed her to present effective solutions to a range of complex problems.

As Chandy's industrial engineering professor, Liz Thompson remembers Chandy's ability to take feedback and improve an outcome as she led a group project in Thompson's class.

"She has both friendliness and technical aptitude, which is a combination that makes her a gifted leader," Thompson said. "Her team felt more competent because she was on it."

Chandy hadn't initially envisioned working in the aerospace industry since she hadn't studied aviation but saw the possibility after a Cal Poly alumnus returned to campus to share the importance of his role as an industrial engineer at Boeing.

As her 2004 graduation neared, Chandy weighed two promising offers: working as an industrial engineer at Boeing; or taste-testing potato chips as part of an operations management job at Frito-Lay.

Chandy passed on the potato chips and packed her bags for Seattle.

Crews spray water on the final Boeing 747 jet as it departs on Feb. 1 from Paine Field in Everett, Washington. (Photo courtesy of Willie Matthewson)

Pleasantly Surprised

Chandy fell in love with the manufacturing side of engineering after starting at the composite manufacturing facility in Frederickson, Washington, producing horizontal stabilizers for the 777 and vertical fins for the 777 and 787.

"We were taking raw materials and making something that flew away," she said.

She worked within composite manufacturing the first 10 years, then moved into senior management and led teams in product development, research and technology, structural design and production on both the commercial and defense sides.

"I've worked at almost every Boeing campus in the Puget Sound," said Chandy, who also earned her MBA from Seattle University along the way. "This is not what I would have guessed my career would look like, but I've been pleasantly surprised."

In December 2021, Chandy was tapped as vice president and program manager for the 747 program to steward the world's most iconic commercial jet into retirement.

The 747 was officially introduced to the world on Feb. 9, 1969, as the largest civilian passenger jet ever conceived at 230 feet long with a 196-foot wingspan and iconic upper deck. During its 54-year run, the quad-engine aircraft has starred in myriad movies and ferried millions of travelers, six presidents and even a space shuttle across the country and around the world.

"The 747 is a true beauty and holds a special place for countless travelers," Chandy said.

'We Are Going to Make It'

Chandy and her group of 600 employees were on a tight timeline to deliver the final 747 to Atlas Air Worldwide – the leading global provider of outsourced aircraft and aviation operating services – and each day brought its own challenges.

Teams contracted COVID, production hit snags and the schedule brought stress, but Chandy's crew held steady.

"There were definitely emotional highs and lows," she said. "We had days where we were killing it to days where everything seemed to be going wrong, but through it all, everyone did a phenomenal job."

As Chandy led the charge to ensure the jet was rolled out of the factory in Everett, Washington, for a barrage of flight tests, she was buoyed by the stories people shared about their connection to the 'Queen.'

Boeing employees known as the "Incredibles" shared their accounts of designing and building the first 747 in just 28 months. Fifty years later, many of their own children and grandchildren worked on the final jet. Chandy also heard the stories of those who immigrated to the U.S. aboard a 747 for a job at Boeing that changed the trajectory of their lives.

"A lot of people really love this airplane," said Chandy, visibly moved. "I get emotional talking about it."

In the end, Chandy's crew hit most of their milestones and all breathed a sigh of relief when the airplane passed its final flight test three days before delivery.

"After a lot of blood, sweat and tears, I thought, 'We are going to make it,'" Chandy said.

Boeing celebrated the final 747 ever made to Atlas Air on Jan. 31. Thousands of Boeing employees watched the rollout of the plane, including Chandy who sat in the front row for the ceremony that was streamed live.

The next day, the Atlas crew paid one more tribute to the "Queen," tracing a giant 7-4-7 and crown design in the sky enroute from the Boeing plant in Everett to the Atlas Air hub in Cincinnati.

"Imagine being in that plane as the pilot made those turns," said Chandy, who awaits her next assignment after the delivery she called bittersweet and gratifying. "It took a lot of hard work, but our airplane flew beautifully." ■

Giving Back

Susan Chandy is committed to giving back to Cal Poly, serving as member of the industrial advisory board for the Industrial and Manufacturing Engineering Department, and regular speaker for clubs and classes.

Chandy recently donated $10,000 to the department to benefit the Process Improvement Lab because her career has been rooted in process improvement.

"This was a fun way for me to contribute," she said. "Learn by Doing is the beauty of Cal Poly."

Persistence Pays Off

Manufacturing engineering student celebrates after a 13-year journey to graduation

by Emily Slater

Vanessa Castellanos is a case study in tenacity. The manufacturing engineering major refused to give up her dream of a college degree despite a slew of challenges that could have led anyone else to quit.

That persistence is finally paying off, however, as Castellanos finishes one last class project and reflects on the milestone that she reached during fall commencement.

Thirteen years after entering Cal Poly, Castellanos is graduating.

"I always felt I had to prove myself to others, for being a first-gen student, coming from a low-income household and from an at-risk high school, for being a Latina female in engineering, for having disabilities, for not being enough in so many aspects," Castellanos said.

"I later realized that the only person I had to prove it to was myself."

'The World was Against Me'

Robotics opened the world of engineering for Castellanos.

She joined the competitive robotics team at Hawthorne High and spent the next three years machining parts for the team's robot, which sparked an interest in manufacturing.

Although she figured Cal Poly was a long shot for college, Castellanos applied and was accepted, much to her amazement.

She started college in summer 2009 but had an admittedly rough transition.

"I had never moved out of my home and had culture shock when I arrived because I was used to more diversity having grown up in LA," she said. "It was also difficult because my parents didn't attend college and they didn't work at companies or have connections in the industry that many of my peers' parents did."

Castellanos loved her manufacturing courses but was terrified by the math and science classes she began to fail.

She tried to change her major to food science, then child development and finally made a hard pivot in 2013, taking a quarter off and returning home to start a bakery – a plan that soon fizzled.

Castellanos carried on with her classes but quickly became overwhelmed due to the generalized anxiety and bipolar disorders she called her biggest hurdle.

"I felt like the world was against me," said Castellanos, adding she logged one more failed attempt to

Vanessa Castellanos celebrated fall commencement in December, 13 years after starting at Cal Poly. She holds a sign in front of engineering Building 192 that represents her journey. "My route was very different from most students, yet I had the same goal in mind," she explained.

Vanessa Castellanos, far right, visits Hoover Dam with members of the Society of Manufacturing Engineers during a 2010 trip to attend the Specialty Equipment Market Association (SEMA) show in Las Vegas. The event showcases various companies in the automotive manufacturing industry.

change her major, this time to liberal studies.

Castellanos took a medical leave of absence in 2015 and contemplated her next move. By 2016, she resolved to return to Cal Poly but spent the next nine months searching for housing.

"I remember praying to a higher power, 'I really want this. Please help me out,'" she said.

Castellanos, left, with friend Patricia Carranza poses in front of the 2010 Cal Poly Universities Rose Parade float, Jungle Cuts. She helped bring to life the float that won the Bob Hope Humor Trophy and the People's Choice Award.

'If There's a Will, There's a Way'

When Castellanos arrived back on campus, her friends had graduated, her financial aid was gone, and she was facing another uphill battle with her classes.

"That year I came back, I failed most of my classes. It was awful," she said.

Through it all, however, Castellanos was bolstered by a support system that included staff and faculty across many departments, including the Disability Resource Center and Engineering Student Services.

"They were my family, and my constant," she said. "I had the most compassionate group of people supporting me."

Advocates included Industrial and Manufacturing Engineering Department Chair Dan Waldorf who guided Castellanos through her requirements, and lecturer Karla Carichner who taught several of her classes.

"It's not often you meet someone who is so determined to get a degree, despite facing many obstacles," Carichner said.

By 2017, Castellanos was making new friends, working with a psychiatrist, finding the right balance of medications and feeling better.

The next years brought more adversity – and a global pandemic – but Castellanos persevered, passing physics on the fourth try and reaching her final class in 2022, earning her the chance to walk during fall commencement.

"Ten minutes before commencement, it finally hit me that I was almost done," she said. "I said some words of gratitude and then I started crying."

Friends and family, along with staff and faculty, celebrated Castellanos during an Industrial and Manufacturing Department ceremony, and over 100 extended family members gathered for a postgraduation party.

"Her story is a testament to focus and persistence for those doubting whether engineering studies are for them," Carichner said. "She could have easily quit or changed majors, but as an obvious problem-solver, she pushed forward toward the career she knew she wanted."

Castellanos, now 31, recently landed a job as a quality engineer at Singer Vehicle Design, where she is putting her degree to good use.

"I know it's a cliché, but if there's a will, there's a way," she said. "Even though school was hard, I found a way and proved to myself that I can do life very well." ■

Sharing Some Hard-Earned Advice

Vanessa Castellanos believes her journey can help others: "If I hadn't been in school for so long and if I hadn't failed, I would not have learned nearly as much."

Here are her steps to success:

- Use your resources: They are there for a reason. If you can be a resource, consider helping someone out;
- Ask for help and accept it when offered;
- Sleep, nutrition and movement are all crucial to your mental and physical well-being. Put your health and safety first;
- Pace yourself in school and in life. Don't let expectations get in the way;
- Find your learning styles and use them to succeed;
- It's aways worth a shot. If you don't try, you won't know. When applying to jobs, don't hesitate;
- When learning new skills, don't expect perfection; and
- Be intentional with every decision and make choices that align with your values.

CELEBRATING
WOMEN
IN INDUSTRIAL
ENGINEERING

Above and on following page, Industrial and Manufacturing Engineering Professor Jill Speece works with IME students in the lab.

Jill Speece Lands Professorship, Joins Former Teachers at Alma Mater

by Emily Slater

Jill Speece has perfected the art of productivity. The new assistant professor of industrial engineering worked in the industry, lectured at Caly Poly and raised a family, all while pursuing a doctorate in systems engineering.

"I started getting up at 4:30 a.m. every day," said Speece, who would crack the books before her two boys woke up for school. "You can get a lot of work done before 6:30 a.m."

Now, Speece is working full-time at the college with the professors who once instructed and mentored her.

"I love Cal Poly," Speece said. "I have gone to three schools, and they are all wonderful, but this is where my heart is."

Speece's journey into higher education started at Cal Poly in

“Embrace opportunities. You don’t have to stay at a job forever, but find the value in whatever you are doing, wherever you are.”

— Jill Speece

1999, when she began studying industrial engineering.

IME Department Chair Dan Waldorf remembers Speece as an exceptional student.

“She was so impressive even then that we all knew she would go on to do great things,” he said.

After graduating in 2004, Speece honed her skills at Raytheon Technologies before she and her husband — a materials engineer from Cal Poly — moved to Colorado for a lifestyle change.

She then worked for a new solar panel manufacturing company, where she watched the growing pains and eventual dissolution of a startup, before joining a medical device manufacturing company – her first foray into health care.

Throughout her ventures, Speece felt the pull of both the Central Coast and Cal Poly.

Her family eventually found a way to move back, and Speece wasted no time contacting the Industrial & Manufacturing Engineering Department at Cal Poly.

“I love school and the university environment, and I knew I wanted to work with students,” said Speece, who earned a master’s degree from USC while working in industry.

She started teaching part-time at Cal Poly while serving as a process improvement consultant at Radiology Associates and researching doctorate programs.

“I was struggling to figure out how to get my Ph.D. because I couldn’t just quit all my jobs and move,” Speece said.

But an online program through Colorado State University gave Speece the flexibility she needed to pursue a doctorate in systems engineering.

She tied her dissertation to a project at Radiology Associates that involved building the system architecture for an automated program that would predict when someone was likely to become a “missed appointment” so office staff could respond proactively.

“I’m a big fan of ‘two birds, one stone,” Speece said.

Speece also used her workplace as a teaching tool while she continued to consult and research.

“I was able to bring my students to Radiology Associates and immerse them in health-care radiology,” said Speece, who believes Cal Poly can become the go-to resource for hospitals looking to improve their health-care operations.

After completing her dissertation, Speece navigated a strenuous hiring process at Cal Poly and was named assistant professor this fall by a recruiting team that included Waldorf.

The faculty now includes three women and nine men who are full-time professors.

“Her hiring will add to the strong group of female role models at Cal Poly that continues to draw a growing representation of women into engineering,” Waldorf said.

He also lauded the combination of skills Speece has brought to the department, drawing on her traditional background at Raytheon and experience in health-care systems at Radiology Associates.

“She is also well-known as a brilliant collaborator, and I expect her to be able to help faculty and research teams with more out-of-the-box thinking toward innovative solutions across our industrial engineering discipline,” he said.

In her classroom, Speece is teaching her students to tackle complex problems by considering how a system’s individual parts influence the larger whole.

“No matter what industry they end up going into, taking a systems engineering approach to systems development is an invaluable skill,” she said.

Speece’s focus on the bigger picture has led to her success in several spheres, and she’s encouraging her students to learn from her journey: “Embrace opportunities. You don’t have to stay at a job forever, but find the value in whatever you are doing, wherever you are,” she said. “Ultimately, find a job you love and not something you settle for.” ■

CELEBRATING WOMEN IN MANUFACTURING ENGINEERING

Autumn Turner Blazes Trail as New Lab Instructor

by Emily Slater

Autumn Turner instructs first-year engineering students in manual lathes and CNC machines in the HAAS Lab.

Autumn Turner found her calling as a manufacturing engineer in a male-dominated field and now hopes to help others do the same.

When she arrived at Cal Poly in 2015, she joined only four other women in the manufacturing program. She then became the only undergraduate woman working in an advanced manufacturing lab her junior year.

"She used to wander over to my classroom to see how she could help," said Jeff Zimmerman, who lectured in an adjoining lab to the one Turner was assigned.

Four years after graduating, Turner has returned to the College of Engineering as the sole woman teaching in a manufacturing lab.

"I like helping students learn," said Turner after leading her first material removal lab class in Building 41. "I also want to open the door wide to women in engineering, showing that these roles do exist."

Turner was introduced to manufacturing at Coalfax High School. She learned to weld in a class where she was the only girl, practiced using a CNC router to cut materials and loved it all.

"I feel like I'm not a terribly creative person, but I can look at something and figure out how it's made," said Turner who grew up watching the Canadian documentary series "How It's Made."

Her interest was solidified when a peer who went to Cal Poly returned to Coalfax High to share his experience studying manufacturing and working in an advanced lab.

Turner wanted to do both, and eventually did.

"I always felt like I was on the edge of what women don't do and I thought that was super cool," Turner said. "For me, pushing boundaries felt exciting and fueled me to go even further."

After graduating in 2019, Turner started work at Empirical Systems Aerospace — a company founded in 2003 by a Cal Poly graduate to supply engineering services and products to the aerospace community.

Turner also remained in touch with Zimmerman, who contacted her about a recent opening for a part-time lecturer that she was eager to fill.

Her new role has given Turner both the chance to return to a learning lab and connect with students who might join her in the field one day.

"I want to create a memorable experience for my students by curating a community while sprinkling in my professional experience," said Turner, who will continue as deputy director of project management at ESAero.

"I always felt like I was on the edge of what women don't do and I thought that was super cool. For me, pushing boundaries felt exciting and fueled me to go even further."

— Autumn Turner

Students in Turner's three-hour class will learn to use manual lathe and CNC mills, along with how to design products for simple, cost-effective manufacturing.

"I want them to think about the cost, quality and impact of a part, then ask, 'Will this add additional costs or is it necessary?'"

Turner is a big believer in asking lots of questions, as she knows it's imperative to lab safety but also to success in the classroom and workforce.

"You can't be afraid to speak up because you may also be helping someone else who has the same question," she said.

As Turner concluded her first class, she was excited to see how many women were enrolled since she said the numbers have risen substantially since her freshman year in 2015.

Counting down the roster, she noted eight of her 23 students are women.

"I would like to see more," she said. "We still have some work to do." ■

Cal Poly Students Win First Place During Cisco Intern Competition

Michael Cassetti, Mahek Karamchandani use classroom skills to solve supply chain problem

by Emily Slater

A group of Cal Poly interns gather during intern week at Cisco's headquarters in San Jose. Engineering students Michael Cassetti, third from left, and Mahek Karamchandani, third from right, were members of a team that won first place in a competition held during the summer program.

Cal Poly engineering student Michael Cassetti earned accolades during his internship with Cisco when he developed a solution to a supply chain problem using skills learned in one of his favorite classes.

Cassetti and over 30 other interns were tasked with creating decision-making models to combat supply chain issues faced by so many companies over the last few years. At the end of the program, the interns all gathered at Cisco's San Jose campus to present their models to a panel of judges who awarded first place to Cassetti's project team, Seize the Data.

Cassetti's fellow IME classmate Mahek Karamchandani also was part of the winning team.

"Taking course material right from the classroom into the workforce is what Cal Poly's Learn by Doing philosophy is all about," said Cassetti, who is in his fourth year studying industrial engineering with a minor in computer science.

Currently, Cisco's business units work individually and handle field failures differently, which can lead to varying customer service experiences, according to Cassetti.

When a part fails in one business unit, for example, the fix could be an easy one, but when the part failure is pervasive across different product families and business units, the issue grows exponentially.

Over the 12-week program, intern teams within the supply chain organization worked with mentors and subject matter experts to build models that would deliver a consistent customer experience regardless of the business unit or product family.

Cassetti knew just the approach he would take after receiving instruction in machine learning algorithms during his Applications of Enterprise Analytics (IME 372) class with Professor Puneet Agarwal.

"I basically took a garbage can of data and made something that was meaningful," said Cassetti who explained that he referenced the same code he learned from Agarwal to align Cisco's customer service, saving money, time and headaches in the process.

Cassetti and Karamchandani collected data from field failure issues on hardware devices along with Cisco's mitigation strategy to train the prediction model using machine learning, just as Agarwal had taught them.

Agarwal, who is in his second year at Cal Poly, instructs his students to clean and analyze data, then use that data to make predictions.

The professor said most companies have a greater ability to generate and store data they then can use to develop solutions instead of merely relying on intuition and experience, making predictive analytics critical.

Agarwal lauded Cassetti for taking a model he learned to apply in his lab to solve an industry problem.

"He knew how to work on a data set, then use the right approach," Agarwal said. "This was Learn by Doing in action." ■

"Taking course material right from the classroom into the workforce is what Cal Poly's Learn by Doing philosophy is all about."

— Michael Cassetti

The 'Smart' Future of Industrial and Manufacturing Engineering

IME chair hits the road to explore how smart manufacturing is making its way in industry

by Taylor Villanueva

Professor Daniel Waldorf wanted to explore manufacturing facilities in hopes of learning more about the future of the industry. After hearing about the progression of smart manufacturing in manufacturing and industrial engineering companies, he sought to learn more about the advancement.

The Industrial and Manufacturing Engineering Department chair took a three-month sabbatical in September 2022 to explore innovative ways the industry is implementing smart manufacturing in Europe, Los Angeles and New York. One of the notable places he visited was the Siemens headquarters in Munich, Germany, where most of the machines are considered to include smart technology.

Smart manufacturing is implemented through sensors that are connected to machinery in factories or elsewhere. The hardware collects the data, which can range from the machine's temperature to its productivity output. The data is then presented in a single place, like a webpage, for engineers to interpret.

As the industrial and manufacturing engineering industry strives to become more methodical, companies are transitioning toward smart manufacturing to increase efficiency and potentially be more environmentally sustainable.

"Smart manufacturing answers questions that would be harder to solve in the past. Now, people can add sensors to devices to read all this information and they can make much better decisions."

— Dan Waldorf

"With smart manufacturing, you can be making better decisions with the information you have," Waldorf explained.

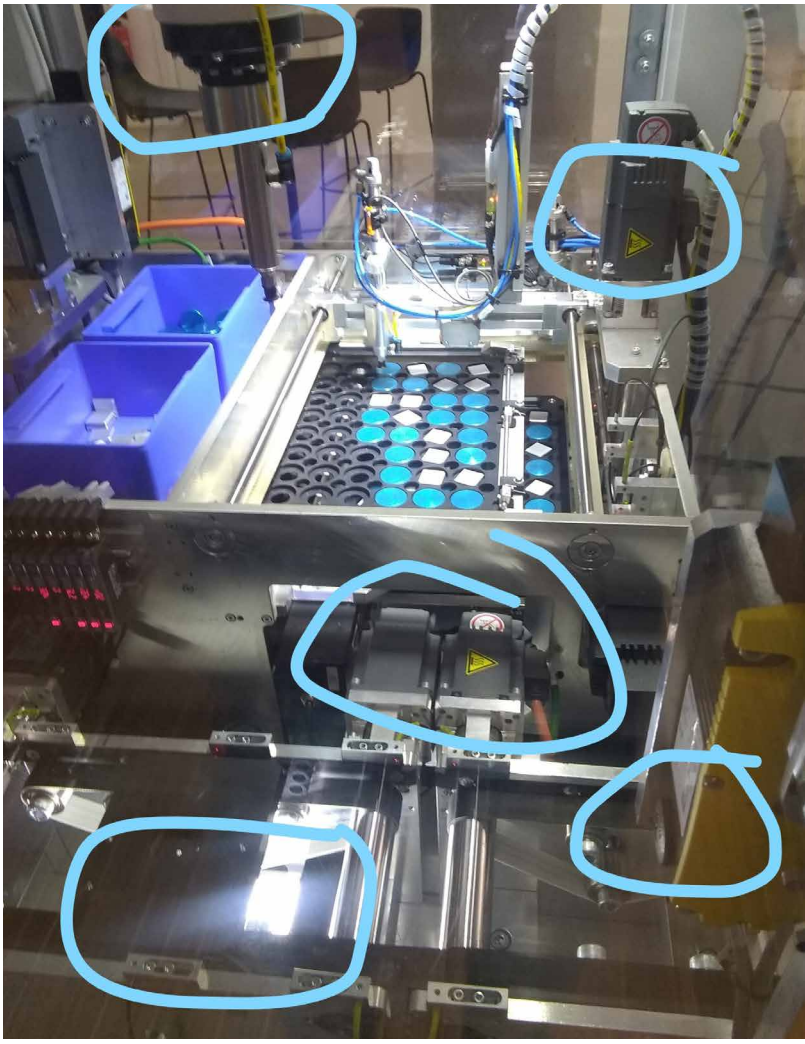
This process can streamline production by compiling data from several machines at a time and displaying the information in a way that is easy to evaluate. For instance, workers can view how efficiently each individual machine is working without manually checking the technology. It is also a simplistic way to track if a machine breaks down.

"Smart manufacturing answers questions that would be harder to solve in the past," Waldorf explained. "Now, people can add sensors to devices to read all this information and they can make much better decisions."

While engineers can manually add sensors that read information from older devices, most newer machines come with built-in sensors, making the process of gathering data easier than ever. Some devices are also guided with lasers that enable the machinery to stay on track.

Because the future of manufacturing and industrial engineering is moving toward smart engineering, Waldorf is considering how to implement what he learned during his sabbatical into his courses.

"Smart manufacturing has been something our industry contacts have talked about recently, especially those who are looking to hire our students," he said. "I wanted my sabbatical and research to bring knowledge and energy that would benefit the whole IME department and that would add real value to students' education."



Industrial and Manufacturing Engineering Chair Dan Waldorf found cameras are everywhere on the smart assembly line at Siemens in Munich, Germany.

Engineering students across the board have relevant skills related to smart manufacturing. For instance, electrical engineers are needed to properly connect the circuits that monitor the machinery, while computer engineers are needed to interpret the data that comes from the machines.

To further explore smart engineering, Waldorf gathered a team of two students who are working on their own smart manufacturing project. Hendrik Botha (manufacturing engineering) and Tillman Erb (industrial engineering) are setting up an equipment monitoring system using machine sensors. Their goal is to collect real-time data of a machine and transfer it to the internet for data processing and analysis.

"The students have different specialties," Waldorf shared. "They make a good team."

Under Waldorf's guidance, the students should be able to read machine data through a portable development circuit board in the hopes of monitoring its efficiency. ■

‘eZcart’ Helps Makes Work a Little Easier for Mobility-Challenged Janitor

Cal Poly IME students take first place at inclusive design competition

by Pat Pemberton

A team of three Cal Poly industrial and manufacturing engineering students took first place at this year’s IDEATE Engineering Competition with their senior project: the eZcart, a janitorial cart designed to help reduce fatigue and discomfort for those with mobility impairments.

Joey Johnson, Jacob Richards and Nico Nuñez, led by faculty advisor and industrial and manufacturing engineering lecturer Jill Speece, participated in the IDEATE Engineering Competition, a national competition held each year which features both university level and high school students developing projects for people with disabilities. Each team competing in the competition is partnered with a non-profit organization, where a subject matter expert, an employee with a disability or other impairment that they go through on a day-to-day basis, works in collaboration with the team’s students to help find solutions on how to improve their workflow and general well-being.

This year, the Cal Poly team developed their project with Alex Zuniga.

“It’s two birds with one stone; that’s the big concept behind the project,” said Nuñez, “Not only helping Alex, but also increasing his productivity.”

Zuniga, a janitor working for local non-profit VTC Enterprises, lives with cerebral palsy, making it difficult for him to fulfill some of the necessary tasks of his job, such as bending down, kneeling and getting back up again. The team developed their project side by side with him, utilizing his knowledge to draw out a few designs, and then build an initial prototype. During the process, they used Zuniga’s feedback to iterate the design into a finished product.

“In our IME department, we propose senior projects every year, so I was looking for opportunities for our students to engage in designing for inclusivity,” Speece said. “This competition was a really good opportunity for the students to use their technical and social skills.”

“My little cousin has a disability that requires the use of a wheelchair, so growing up with him I’ve gotten used to being crafty and finding different ways to include him in things, and to have fun despite that. So, then I thought, ‘oh this is a great opportunity to use my engineering skills and help someone else,’” said Nuñez.

As a team of seniors getting ready to graduate, the ability to work on tangible projects in partnership with real companies and employees provided a unique opportunity for the students.

“As much as we’re jumping into industry and we’re going to be learning in industry, this project really reminded me how valuable it is to be able to be in a situation that is pretty rare. That’s because of Cal Poly, where we are learning the academics but are also doing a real, professional project at the same time. The chance to combine those things is very rare and this senior project is a perfect snapshot into the power of Learn by Doing,” said Johnson.

“The students did such a great job working with Alex that VTC Enterprises wants to keep doing senior projects with our students in the future. That in and of itself speaks volumes as to what the students accomplished,” said Speece.■

Alex Zuniga, left, stands with students Nico Nuñez, Jacob Richards, and Joey Johnson and their IDEATE Competition winning project, the eZcart.

“As much as we’re jumping into industry and we’re going to be learning in industry, this project really reminded me how valuable it is to be able to be in a situation that is pretty rare.”

— Joey Johnson

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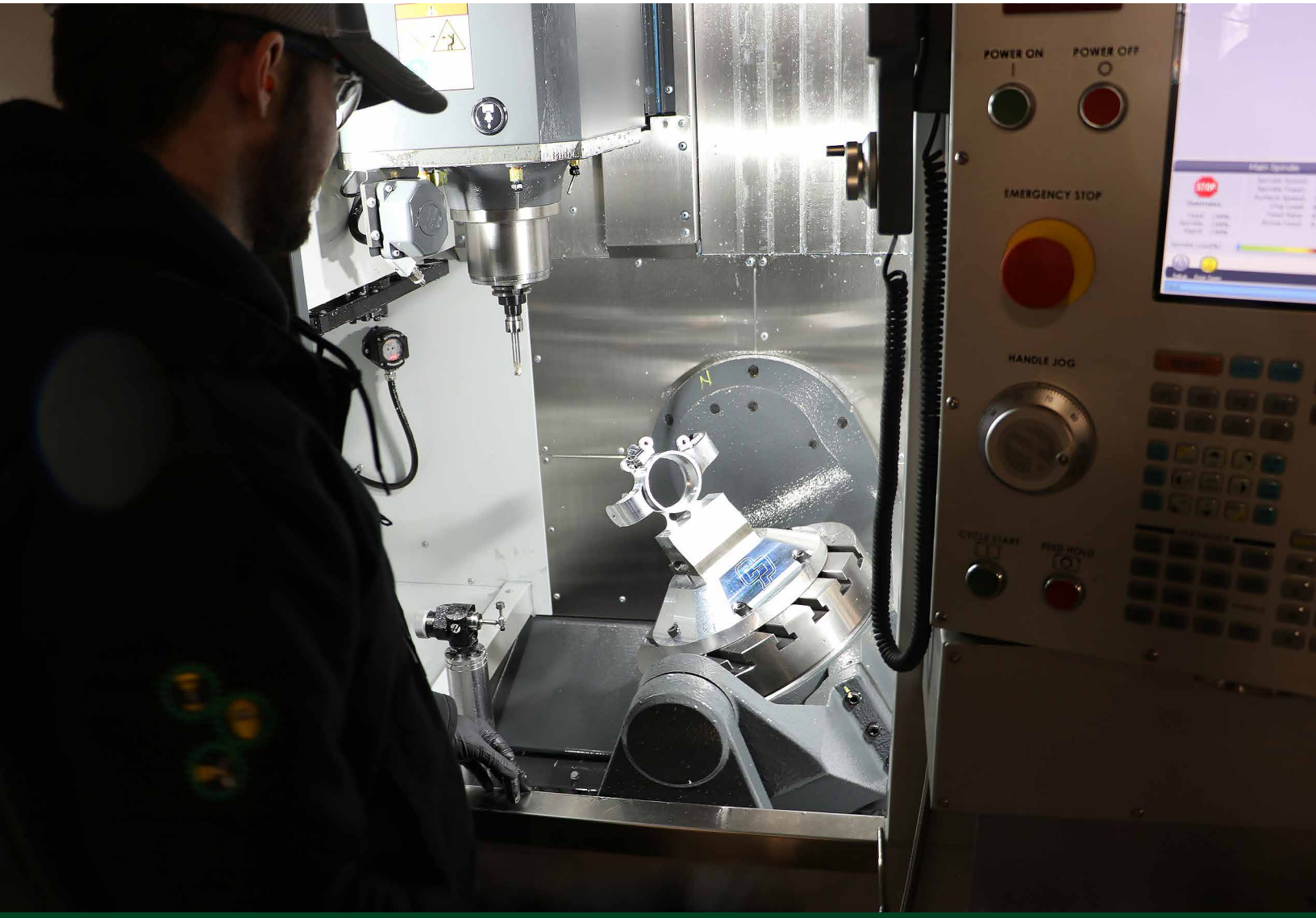

Shop Tech Patrick Wiseman (manufacturing engineering) makes a part for the Cal Poly Baja Car in the HAAS Lab.

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