Carnegie Mellon University

MAKE POSSIBLE

THE CAMPAIGN FOR
CARNEGIE MELLON UNIVERSITY

COLLEGE *of*
ENGINEERING

COLLEGE *of*
ENGINEERING

ADDRESSING REAL-
WORLD CHALLENGES.

EMPOWERING TOMORROW'S
PROBLEM-SOLVERS.

SHAPING THE FUTURE
FOR THE BETTER.

THIS IS HOW

WE ENGINEER *what's* POSSIBLE.

"As a world-class institution, the College of Engineering is committed to educating creative and technically strong engineers and pioneering solutions to global challenges. We do this with an unprecedented dedication to integrating across disciplines."

WILLIAM SANDERS
William D. and Nancy W. Strecker
Dean of the College of Engineering

Our world is changing faster than ever before, and its problems are bigger and more complicated. Knowledge used to advance from insight to insight, but its once steady expansion has turned exponential. At the intersection of emerging voices and data, complex issues are arising — demanding new models for collaboration. Now more than ever, we must work together to innovate.

Carnegie Mellon engineers are constructing a better world: one that is energy-efficient and more connected, where technology can be trusted. We will drive the technological leaps that will create the future.

We are also responding quickly and creatively to COVID-19, adjusting research and coursework to the needs of the moment. Doing what they do best, our engineers are tackling the complex challenges ahead.

Your philanthropic support of the College of Engineering through *Make Possible: The Campaign for Carnegie Mellon University* will enable us to:

- Solve problems by leveraging the power of Advanced Collaboration.®
- Enable engineers to create breakthrough innovations.
- Produce exemplary engineers based on multidimensional learning.

The College of Engineering is doing work that people can see, touch and imagine in their daily lives. Your support will drive our transformation and lift our reputation. More importantly, you'll help elevate expectations of how exceptional tomorrow can be.

TOGETHER, WE WILL MAKE IT POSSIBLE.

SOLVE PROBLEMS BY LEVERAGING THE POWER OF ADVANCED COLLABORATION®

THE CHALLENGES WE FACE ARE SO COMPLEX, THERE'S ONLY ONE WAY *to solve them:* TOGETHER.

Whether it's pushing the boundaries of robotics, advancing clean energy technology or one day making the organ transplant list obsolete, the College of Engineering's culture of Advanced Collaboration® goes beyond the conventional ways of working. It's an interdisciplinary model, deeply native to Carnegie Mellon, that can better tackle the urgent questions facing our world.

BY COMBINING FUNDAMENTAL SCIENCE AND APPLIED ENGINEERING,

WE ADVANCE ROBOTICS *in* UNIQUE WAYS.

Robots by way of biology. It's the kind of cross-disciplinary thinking you get with Advanced Collaboration® — the driving force within our College of Engineering and, in many ways, the heart of everything we make possible.

Take the challenge of sensing and responding to a threat. It's something that presents a complex problem for a machine. But to soft-bodied organisms like octopi and cuttlefish, it's second nature. Animals like these are able to use their cells to quickly sniff out trouble, then camouflage themselves to hide from it.

Drawing inspiration from these animals, Kyle Justus, an alumnus of our doctoral program in mechanical engineering, collaborated with researchers to incorporate engineered bacteria into a soft robotic gripper, giving it the ability to "sense." He says, "These organisms have cells that can sense and respond to their surrounding environment and basically act as soft machines. That's really exciting to us."

Justus and his team have taken a novel approach to research, but they're far from alone in exploring connections between the natural and mechanical worlds.

Victoria Webster-Wood, assistant professor of mechanical engineering, is another researcher whose team focuses on how we could potentially use organic living materials in robotic systems. Aside from advancing the growing field of soft robotics, her team's work offers benefits beyond the task. "If an organic robot interacts with other organisms in the environment, breaks down, or reaches the end of its mission," she says, "it can naturally degrade as part of the environment."

No trace of life is too small to drive robotic research — not even DNA itself. "These days, I tell people that I work on very tiny medical devices," says Rebecca Taylor, assistant professor of mechanical engineering. Her team is developing micro- and nano-scale robots that can perform a range of medical tasks. But Taylor has even smaller plans: "We're trying to make the smallest magnetically actuated microswimmer, something that could actually swim through your capillaries. And we're really interested in asking the question 'Can we organize DNA to make nanostructures, and use them as adapters to build bigger things?'"

Exploring remote places. Developing earth-friendly robots. Your support can make anything possible.

"At CMU, we work together to have a much bigger impact societally. In my group, we have students from physics, chemistry, and chemical and mechanical engineering. One of the things that I like so much here is that it really fosters collaborative activity."

REBECCA TAYLOR
Assistant Professor of
Mechanical Engineering

SOLVE PROBLEMS BY LEVERAGING THE POWER OF ADVANCED COLLABORATION®

BARRIERS DON'T STOP US.

OUR HISTORY OF GROUNDBREAKING INNOVATION *proves it.*

Here in the College of Engineering, we're bringing together researchers from across disciplines to find elegant solutions to complex challenges.

With your support, we will:

Accelerate research through state-of-the-art facilities.

We will build on our robust and ongoing efforts to expand and reimagine our teaching, meeting and maker spaces. Be they multidisciplinary laboratories, open workspaces for tinkering or reconfigurable classrooms that respond to the needs of the moment, we will create environments conducive to spontaneous interaction and powerful innovation.

Encourage and support innovators.

We will draw on our strong culture of Advanced Collaboration® to drive large, center-level research proposals; to pursue seed funding for faculty research; and to advance other strategic programs such as moonshot initiatives. By nurturing the college's best big ideas, we'll foster cross-cutting research that could lead to future centers of excellence.

YOU CAN BRING TOGETHER INSPIRED MINDS TO MAKE GAME-CHANGING IDEAS A REALITY.

Help us make it possible by providing critical support to our college's faculty and students through:

RESEARCH SEED FUND

Accelerate promising ideas and empower engineers to develop concepts that hold greater uncertainty, but have potential for high-impact breakthroughs.

SCAIFE HALL

Transform Scaife Hall into a state-of-the-art learning and research environment — including a robotics laboratory and an interdisciplinary cyberphysical systems laboratory — that gives future engineers a starting point for forging bold new paths.

EXTRAORDINARY FACULTY OFFER NEW-TO-THE-WORLD SOLUTIONS *and*

TRANSFER THAT KNOWLEDGE *to the* CLASSROOM.

Carnegie Mellon engineers innovate differently — by working fluidly across disciplines. Defined by their creativity, technical excellence and thought leadership, they create entirely new categories in their fields. Here, pioneers and risk-takers come together to make big bets that have an even bigger impact on our society.

BY REIMAGINING HOW MATERIALS BEHAVE AND REACT, *we can* SHAPE EXCITING *new* POSSIBILITIES.

Carmel Majidi and his Soft Machine Lab research group are reshaping technology, beginning with how machines interact with the natural world, and sometimes blurring the lines between the two. Or as Majidi, who is the Clarence H. Adamson Professor of Mechanical Engineering, puts it: “Robots that would be compatible with human tissue.”

So far, Majidi’s team has made its mark with a material dubbed “Thubber” — a name that’s short for “thermally conductive rubber.” Used for heat management in industries like automotive and aerospace, Thubber is a kind of rubber infused with liquid metal microdroplets.

Other innovations coming from Majidi’s team include a soft, stretchy, skin-like magnet that can give robots or other materials a sense of touch, and an intelligent, shape-morphing, self-healing material for soft robotics and wearable electronics.

“You can look at these materials as functioning as artificial skin, artificial nervous tissue or artificial muscle, to help support or augment the natural corresponding tissues we have in our bodies,” says Majidi.

This inventive work is all part of the larger goal of pioneering the next generation of multifunctional, wearable technology that can move with us, and behave as part of us. When you support our pursuit of practical leading-edge technology, you’ll help our teams continue to challenge the boundaries — and cross new frontiers — of what we can make possible.

“If we want to build machines that are more compatible with the human body and the natural environment, we have to start with new types of materials.”

CARMEL MAJIDI
Clarence H. Adamson Professor of Mechanical Engineering

VISUALIZING DATA *and* DECODING ITS POWER.

To make data make sense, it helps to make it visible. Understanding why underpins the research of Yuejie Chi, associate professor of electrical and computer engineering and the Robert E. Doherty Career Development Professor. Her team is pioneering ways to visualize complex science and engineering data, but their pursuit of new schemas is balanced by a fascination with the old: “Our goal is to understand why simple heuristics work so well in practice, so we can theoretically understand why they’re so successful.” In other words, why are some ways of illustrating data more compelling than others, and what’s the science behind it? While seeking these answers, Chi actively collaborates with colleagues from many fields, including statistics, mathematics, electrical engineering and computer science — bringing data to life in quantifiably powerful ways.

WITH PIONEERING MINDS AND OUTSTANDING TALENT, *we will* SHAPE

THE FUTURE OF ENGINEERING.

By approaching the future with the spirit of creative innovation, we will ask the questions that spark groundbreaking research.

Innovation occurs when we:

Attract and retain the best and brightest.

We'll bring together the very best engineering minds from across disciplines to confront complex challenges and to accelerate critical solutions. We'll invest in our faculty early on, encouraging them to be risk-takers in their fields and allowing them to grow and prosper at Carnegie Mellon.

Advance technology-enhanced teaching and learning.

We'll provide the state-of-the-art facilities, advanced tools, skills development and other resources to maximize the residential education environment.

YOU CAN BE THE CATALYST THAT MAKES UNPRECEDENTED RESEARCH POSSIBLE.

Help us provide critical support to our college's faculty and students through:

ENDOWED PROFESSORSHIPS
Support for endowed professorships provides our renowned faculty with needed funding and greater freedom in their research.

ENDOWED FELLOWSHIPS
By providing graduate fellowships for our best and brightest students, we can enable these growing innovators to tackle real-world challenges in the lab, explore new ideas in the classroom and collaborate with leading professionals in industry.

INNOVATION FUNDS
These funds will help to address the most urgent needs of the college and its departments, providing resources for breakthrough research projects, equipment for labs or experiential learning opportunities.

ENGINEERING *touches* EVERY ASPECT OF LIFE. IT NEEDS TO BE LEARNED *hands-on.*

Learning by making is an integral part of our student experience. In every corner of the college, we offer opportunities to experiment, create and fabricate through courses, competitions and entrepreneurial endeavors. Students work side by side with faculty on projects that solve real-world problems.

WHEN WE PROMOTE LEARNING BY MAKING, WE FOSTER

CREATIVITY *in* PROBLEM-SOLVING.

Multidimensional: It's a concept with great meaning for the College of Engineering. It describes the challenges that we must confront, the solutions that we must consider and the thinking that we need to accomplish world-class engineering. Most of all, it describes the approach and disposition of the university's engineering faculty and students. And those ideas connect directly to another essential concept: learning by making.

Engineers are builders and makers. Therefore, in the College of Engineering, we prioritize hands-on problem-solving across our academic and research programs — as well as the recreational ones. For example, students participate in Spring Carnival's famous buggy races to design and build fully electric Formula One style race cars on the Carnegie Mellon Racing Team, and compete in the Department of Electrical and Computer Engineering's (ECE) Build18 freestyle tinkering competition.

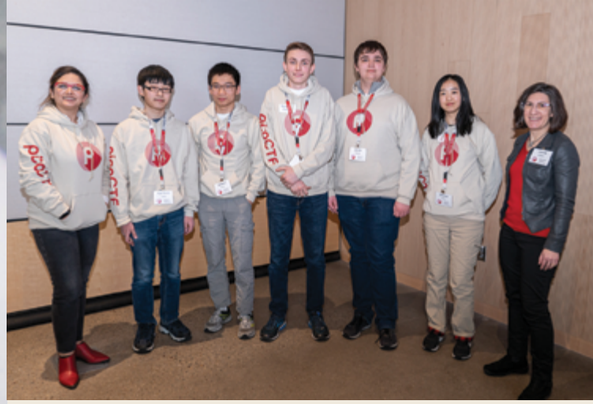
Build18 was started more than 10 years ago out of ECE students' desire to spend time on their own projects, for the pure joy of experimentation. The one-week event now attracts participants from across the university and includes opportunities for students to learn how their projects might be adapted in the real world.

In every department across the college, students make and create inside and outside the classroom — building solutions based on creative and technical know-how. For example, in the Tech Spark, students immerse themselves in the college's learning-by-making culture. This makerspace, designed specifically for bringing ideas into reality, offers specialized design and prototyping equipment, and the dedicated support of both a student team and a professional staff. The Tech Spark's state-of-the-art facilities extend seamlessly from Hamerschlag Hall's design facilities into the new ANSYS Hall's large high-bay assembly space.

Completed in 2019, ANSYS Hall stands in service of the college's multidimensional way of thinking, creating and solving. This 36,000-square-foot space is designed to develop large-scale prototypes and technologies, and provide a myriad of areas for meeting, learning and working. Courses from departments across the College of Engineering can take advantage of the opportunities for hands-on learning experiences in the building's expansive design, fabrication and construction areas.

A new Scaife Hall, coming in 2023, will further extend these important ways of working into our newest facility. It will feature multipurpose classrooms and collaborative labs designed to cultivate new research fields at Carnegie Mellon.

When you support the dynamic maker culture of the College of Engineering, you'll play an active role in showing the world what we make possible.



HACKING THE FUTURE *of* CODING.

Putting knowledge into practice is the most effective way to learn. And at Carnegie Mellon, the proof is in picoCTF. At picoCTF, a digital capture-the-flag contest, students take part in the world's largest online cybersecurity competition, in which more than 100,000 students worldwide have participated since it launched in 2013. The event invites middle and high schoolers to apply their hacking skills for a shot at cash prizes and, for the top teams, a trip to CMU. Through this powerful and immersive hands-on experience, we inspire young people to see where STEM can take them. It's easy to see the power of learning by making. With your support, we will never stop showing the world what engineering can make possible.

"We want to be a place for everyone, with the physical, digital and intellectual resources open and available."

DIANA HAIDAR
Assistant Teaching Professor,
Mechanical Engineering

PRODUCE EXEMPLARY ENGINEERS BASED ON MULTIDIMENSIONAL LEARNING

BY ENERGIZING THE MAKER CULTURE AT THE COLLEGE OF ENGINEERING, *we will* ENHANCE

HANDS-ON EXPERIENCE

AT THE HEART OF EVERY STUDENT'S LEARNING.

With your support, we will:

Cultivate the maker ecosystem.

We'll fuel the engineers of tomorrow by giving them opportunities to put their disciplines into practice, in facilities that encourage and enable student activities, research and inventive hands-on learning.

Catalyze learning outside the classroom and lab.

Registering for and traveling to and from conferences and internships can be costly, but the experience and networking opportunities are invaluable. By helping students pursue these outside opportunities, we will help them grow as engineers, citizens and future leaders.

Grow the leaders of tomorrow.

By providing programs and initiatives for students, we'll prepare our engineers to take on new leadership roles and accelerate their skills in key areas like negotiation, planning and more.

YOU CAN UNLEASH THE POWER OF LEARNING BY MAKING.

Help us make it possible by providing critical support to our college's students through:

MAKER ECOSYSTEM

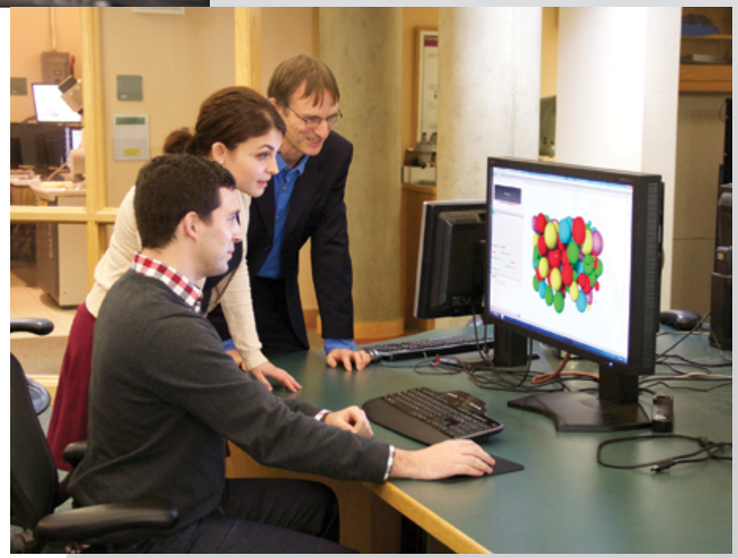
We'll support programming and initiatives across our maker ecosystem, in places like the Tech Spark and ANSYS Hall. For example, we'll develop additional opportunities and cutting-edge curriculum to enable our students to pursue research and inventive hands-on learning.

UNDERGRADUATE RESEARCH AND TRAVEL FUNDS

With this funding, we'll help our students grow through experiences and initiatives that promote discovery and understanding across disciplines and cultures.

EQUIPMENT AND INSTRUCTION FUNDS

By creating access to state-of-the-art equipment and resources, we'll improve the capabilities of faculty and students to conduct groundbreaking research.



WHAT BUILDS A
BRIGHTER WORLD
FOR EVERYONE
is what we MAKE POSSIBLE.

JOIN US.
TOGETHER, *we will make this*
INNOVATIVE FUTURE *for* THE
COLLEGE OF ENGINEERING
POSSIBLE.

"With a culture that is interdisciplinary to the core, the College of Engineering is rising to the challenges of our rapidly evolving world, and catalyzing the relentless, impact-driven innovation that Carnegie Mellon is known for — and what we do best. This is where the next generation of engineers make, create and innovate — all at the cutting edge."

FARNAM JAHANIAN
President
Henry L. Hillman President's Chair

Carnegie Mellon University

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