

DECEMBER 2021

# EMPOWER

## Cal Poly Student Association



**FALL  
NEWSLETTER  
2021**

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**CAL POLY**



# EMPOWER Student Association

## Acronym

Endeavors to Move  
People  
Onward With  
Engineered Results

## Mission Statement

EMPOWER is a multidisciplinary student association on a mission to create better everyday life through engineering and innovation.



## Fall Quarter 2021 In Review

The EMPOWER Student Association was both thrilled and ready to bring back in-person project collaboration this Fall quarter. Though three of our 2019-2020 Formal Design Projects were put on pause due to the global pandemic, we were able to re-introduce these projects along with two projects from 2020-2021. Our first yearlong sponsored project was also introduced this Fall, which brought us to a total of six Formal Design Projects for this academic year! Once these teams were formed in November, they began their year-long journey to research, design, and innovate. These projects range from crafting prosthetic arms and legs to creating a visual inspection system for medical devices! Additionally, we had approximately 40 students participate in our Fall Quarterly Design Project. Members met during our weekly general meetings to design an outdoor exercise facility for a non-profit organization called Achievement House. Moreover, our LLEAP (Lower-Limb Exoskeleton Assist Project) team has continued to work tirelessly to engineer an exoskeleton suit for a local Cuesta College student named Tamar, who has quadriplegic cerebral palsy. Other events that we hosted this quarter included: SolidWorks and 3D-printing workshops, a hike to Madonna mountain, and an info session about UC Berkeley & UCSF's Master of Translational Medicine program.





# Quarterly Design Project

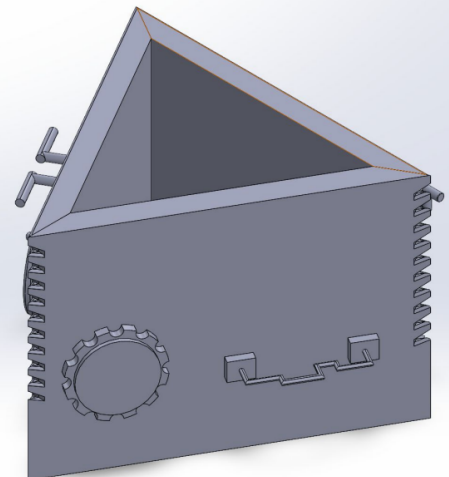
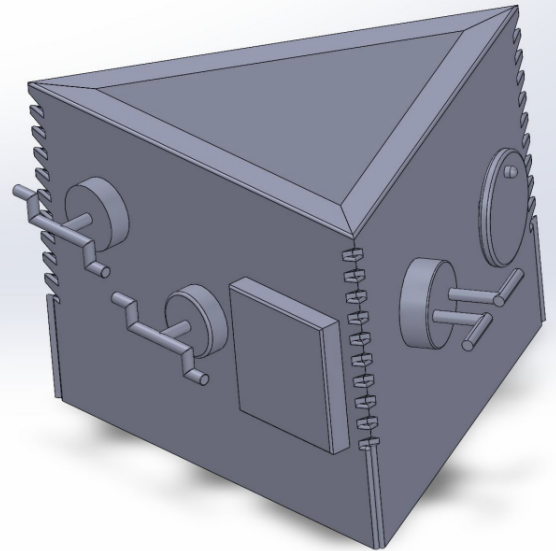
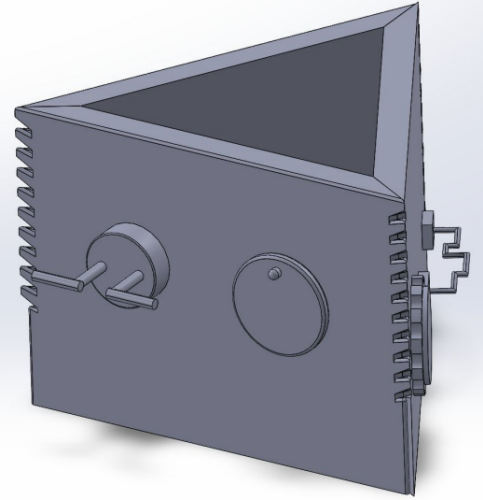
Fall 2021



ACHIEVEMENT  
HOUSE, INC.

## Achievement House Partnership

Our Fall Quarterly Design Project (QDP) presented our members with a unique and challenging prompt dedicated to improving a local facility known as Achievement House SLO. Achievement House is an organization with locations across the greater SLO county “dedicated to providing services that encourage and support individuals with disabilities, so that they may successfully achieve their personal and professional goals.” Members were tasked with using the provided workspace at Achievement House to help design a piece of outdoor exercise equipment that is accessible to those with physical disabilities and other limitations. Members were separated into eight teams to define their project's scope and design a unique solution. After seven weeks of work, each team presented their final ideas to the Officer Board. One team was selected with input from Achievement House to continue developing their model over the next two quarters. Their end goal is to deliver a final product to this non-profit! Team members include Michael Grandi (2nd year IE), MakenaMoragne (1st-year BMED), Ciara Murphy (1styear BMED), Nick Perlich (1st year CS), and NickWaizenegger (2nd year IE). A 3D model of their design is shown on the right.



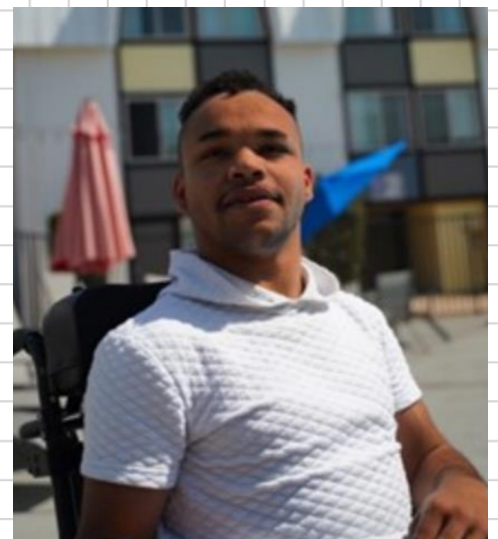
# LLEAP

## Lower-Limb Exoskeleton Assist Project

Over the last 2020-2021 school year, Lower Limb Exoskeleton Assist Project (LLEAP) members were hard at work. Through many Zoom calls and breakout rooms, we were able to further develop our exoskeleton design and also start a new group: our Simulation team! We decided to make this shift to a simulated model of the exoskeleton since we were unable to access the physical lab. A simulation allows us to test software and make design changes without needing physical equipment. Thankfully back in person this past fall quarter, we were able to continue the simulation while picking up right where we left off with all other efforts.

During the quarter, our Prototyping team researched and selected motors and regrouped old designs. Mechatronics trained new members and developed preliminary PID control. Sensing and UI created a mock UI button system and a strain gauge amplifier circuit. Software and Simulation teams studied kinematics to develop control trajectories and a simulated model, respectively.

Although the transitions to and from virtual work were not simple, we are proud of everyone for sticking through it together and doing amazing work as a result. Our next steps will be to delve into manufacturing our first design and testing control code on our simulation, seeing all of our hard work come to life! We're super excited to welcome everyone back as we dive into this next quarter!





# FORMAL DESIGN PROJECTS

2021-2022

## Fall Quarter Progress

Our Formal Design Projects (FDPs) are the cornerstone of our organization. Each FDP team works with a "challenger" who presents a given challenge as an opportunity to create an innovative solution. These challengers can be individuals with disabilities, organizations, and, in past years, even pets! Due to COVID-19, three projects from the 2019-2020 school year and two projects from the 2020-2021 school year were halted during the prototyping/manufacturing phases. This year, with greater access to on-campus facilities, we're excited to resume work on these five projects and introduce a new one, sponsored by Edwards Lifesciences! In November of 2021, six teams were formed to take on the following challenges. We look forward to the innovation and discoveries that are to come from these teams for the remainder of the academic year.

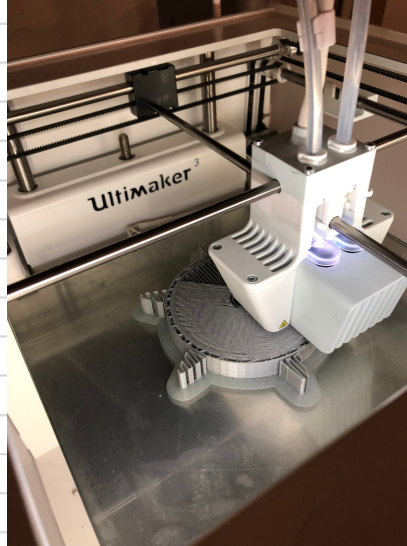


# Edwards Lifesciences Variable Measurement System for Coating Defects

Formal Design Project 2021-2022



Edwards



## **Problem Statement:**

Coatings are used extensively on medical devices to serve a variety of functions such as hydrophobicity, electrical isolation, and corrosion resistance. The integrity of these coatings is meticulously monitored by means of inspection throughout the design process. Edwards Lifesciences currently has a validated inspection method that produces attribute data (pass or fail), but it is not without hurdles since operator subjectivity is often present in manual, visual inspections. The creation of a variable inspection system, whether fully-automated or camera-assisted, is an avenue to mitigate operator subjectivity, monitor product stability, and produce better component yields.

## **Project Summary:**

The members of our team are Tarnvir Dhaliwal (3rd year BMED), Jadon Bradford (3rd year BMED), Krystal Cardenas (3rd year BMED), Brooke Ellis (1st year BMED), Noah Jeffery (2nd year BMED), Logan Vandembroucke (4th year BMED), Emily Rhee (2nd year BMED), Nick Perlich (1st year CS), Jack Foxcroft (2nd year ME), Allie McAuliffe (1st year BMED), and Janet Flores (2nd year transfer BMED). Based on the provided problem statement, the teams have been selected and began conducting background research and design ideation. We are in direct contact with Edwards Lifesciences to receive the items and begin testing to better understand and identify the traits, needs, and challenges of this project. Once this project scope is solidified, we will begin creating the first iteration of our system.



# Hand for Beth

## Formal Design Project 2021-2022



### Our Challenger:

Beth Parish is a local San Luis Obispo county resident who has lost her legs, her right arm and her three left fingers due to sepsis. Beth would like to have finger and arm prosthetics made for her that would allow her to grasp objects such as a door knob, knife, or a pen. Previous FDP teams have worked hard to design a hand and arm prosthetic for Beth, but COVID-19 got in the way of manufacturing. Beth is excited for this team to build on previous designs and give her the opportunity to be able to complete daily tasks again.

### Project Update:

The members of our team are Autumn Ebner (3rd year BMED), Juan Luna (3rd year ME), Yotam Barr (1st year ME), Allison Lee (3rd year ME), Will Toll (2nd year BMED), Shannon Robinson (2nd year ME), Eunice Bernardo (4th year EE), and Yu Honda (4th year EE). The project was split into multiple parts, each with its own varying level of completion. The main part, the fingers, are completely finished and need to be printed in order to determine if they work according to plan or if anything needs to be redesigned. The electronics design is also completed and like the fingers need to be prototyped and tested in order to determine if any changes need to be made. The shell meant to hold the electronics is in the beginning design stages and may need to undergo a complete redesign. Overall, the smaller pieces like the fingers and the electronic components are done and are ready to move into the prototyping stage, while the larger components like the shell and the components attaching the whole design to the wrist will require more design before moving into the prototyping stages.

# Arm for Beth

## Formal Design Project 2021-2022



### Project Update:

Our team consists of Daniel Dominguez (3rd year BMED), Skylar Rose (2nd year BMED), Jeffrey Wisoff (3rd year ME), October Wahlberg (4th year BMED), Kelsi Cappetto (5th year BMED), and Marissa VanDeVeer (3rd year BMED). We are currently aware of all the parts that the arm requires: harness, brace, hinge, socket, arm, clamp. We are currently in the process of finalizing designs of the parts we can make: arm and clamp. We need to prototype these two so we can decide on the final materials. The parts we can't make: we have the harness; it needs to be built. We have decided on a flail hinge for the type of hinge we will use. We now need to obtain it. We are still trying to decide how her arm will be socketed: this is a more difficult topic since Beth's residual limb is sensitive and bulbous. We are looking at a few options. The brace still needs to be investigated. We are really starting to think about how each part will be connected to the other.

Next steps will be obtaining the hinge. Along with that is figuring out how each part will connect to the other. It will be very useful to meet with Beth in order to gauge the arm with her real body. This will also be useful in figuring out how to socket the arm. Prototyping will begin as soon as we have parts printed at school.



# Braces for Bill

Formal Design Project 2021-2022



## Our Challenger:

Bill is an Emeritus Professor of Public Health Sciences at the University of Virginia School of Medicine. In 2014, Bill severely injured his leg during a 100-mile bike ride and was later given an ExoSym brace from the Hanger Clinic to help him remain active. While this device has helped, he's challenged our team to create braces that are specialized for handling all-terrain conditions so that he can relive the joys of hiking. A previous FDP team worked to design these braces for Bill, but COVID-19 got in the way of manufacturing. Bill is hopeful this new team will improve on the previous design and give him the opportunity to hike again.

## Project Update:

The members of the Braces for Bill team are Nick Waizenegger (2nd year IE), Paul Heli (3rd year BMED), Jacqueline Mendoza (3rd year ME), and Michael Grandi (2nd year IE). Currently, the project is in the research and design phase with the goal of prototyping in the next first few weeks of the winter quarter. Also, we will be designing the initial brace in SolidWorks. We plan to implement some form of springs below the bottom of the shoe to assist Bill's plantar flexion. In addition, we aim to have some form of the band pulling up his heel causing a natural falling of the toes. Looking forward, we plan to optimize the initial design to offer a wide range of support while hiking on all-terrain as well as normal day-to-day walking.

# Lift for Alex

## Formal Design Project 2021-2022



### Our Challenger:

Alexander Fung is a senior Aerospace Engineering student at Cal Poly. In 2012, he fell from a cliff and was paralyzed. While traveling used to be a hobby of Alex's, he now feels as though he's lost much of his independence. Alex uses a motorized lift to move from his bed to his wheelchair and vice versa. In a home setting, this works fine but getting in and out of bed proves to be a hurdle which keeps Alex from staying at hotels. Hotel rooms vary drastically in size and layout and often don't have the necessary space for the industry's idea of a portable lift to operate. A former FDP team worked to develop a portable lift but COVID-19 got in the way of manufacturing. This next year Alex is hopeful that EMPOWER can improve upon the previous team's design and manufacture a final product so he is able to travel again. Alex looks forward to finally visiting family overseas after 10 years apart.

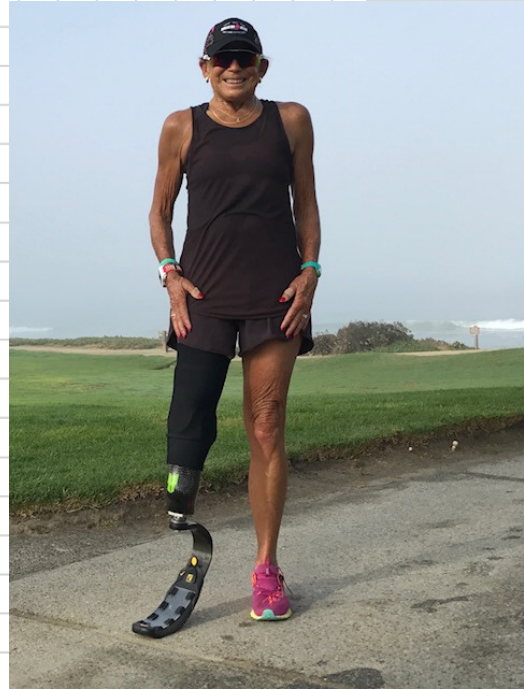
### Project Update:

The team members for Lift for Alex are Hudson Kispert (3rd year ME), Daniel Nordstrom (3rd year BMED), McKinna Lee (3rd year BMED), Cole Burk (3rd year BMED), Ciara Murphy (1st year BMED), and Jack Hauser (3rd year BMED). The Lift for Alex project has a good foundation at the moment with a detailed CAD assembly and FEA and stress calculations on multiple components. The first order of business our team will address is completing the final design which includes designing a bearing and hinge for the lift. After that is complete, we will test our design again using FEA and statics/ mechanics of materials as we prep for prototyping. Prior to prototyping we will observe and organize the bin of the previous team's supplies and determine a bill of materials needed for the prototyping process. I am anticipating prototyping to begin in week 3 or 4 of this upcoming quarter.



# Leg for Karen

Formal Design Project 2021-2022



## Our Challenger:

Karen is a world class athlete with a trans-tibial amputation. She regularly competes in a variety of races including Ironman triathlons. In the past, EMPOWER designed a training fin prosthesis for Karen. Now, she is looking for a prosthetic leg that will allow her to get back into hiking. The challenge will require the team to engineer a comfortable prosthesis that can traverse rougher terrains. A former FDP team worked to develop this prosthetic leg, but COVID-19 got in the way of manufacturing. Karen is hopeful that this team can improve on the previous design and deliver her a final product to be able to hike again.

## Project Update:

The team members for Leg for Karen are Andrea Ng (4th year BMED), Kyu Rhee Han (2nd year BMED), Nicole Morris (1st year BMED), Anna Dion (2nd year BMED), Aditi Sriram (3rd year BMED), Hayden Scoular (3rd year BMED), and Rachel Rowe (2nd year BMED). In terms of the project, all the members were able to read the previous materials given & familiarize with where the project is at thus far. The ankle design is already pretty solid so there isn't need for much editing in that section, but the foot design is still in the beginning stages so lots of emphasis will be needed for that. For next steps, we will split into Leg and Ankle Teams so everyone can be focused on something more specific. Our first technical step will be to finish up the designs & modify them so that we can start the prototyping & manufacturing as soon as possible. Since we will need more assistance regarding the composite materials & carbon fiber layups, we will reach out to faculty advisors & other clubs on campus that might be able to provide insight.

# Looking Forward

**2021-2022**

After a long Winter Break, we are excited to kick off Winter Quarter 2022. Our Formal Design teams will prepare for their Preliminary Design Reviews during Week 3, where they will get feedback on their designs from the Officer Board, faculty, and anyone else that the teams invite. During our general meetings, we will be offering a series of workshops to supplement student coursework as well as hosting some industry guest speakers and offering additional networking events.

Thank you for your interest in the EMPOWER Student Association! If you would like more information about what we do, or would like to get involved in our mission, please check out our website at <https://www.cpempower.com>, email us at [cpempowerops@gmail.com](mailto:cpempowerops@gmail.com), contact our faculty advisor, Dr. Lily Laiho, or our president, Pearse Lipscomb.

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