

**California State University Long Beach
Mechanical and Aerospace Engineering**

Senior Design Engineering Project Exhibition

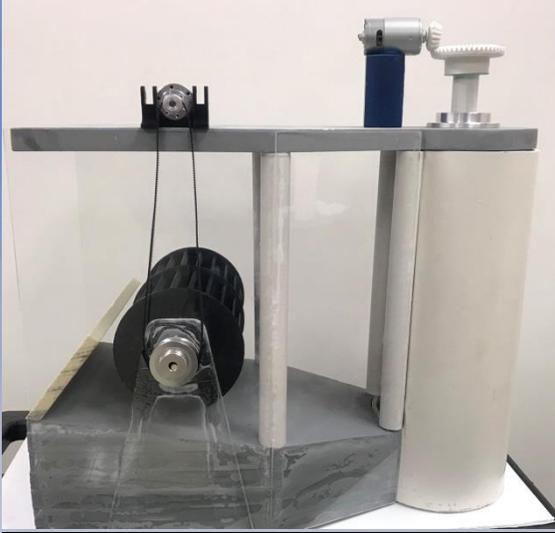
**Wednesday December 12, 2018
NIGGLI CONFERENCE CENTER, ECS 312
From 5 to 7pm**

About this expo: This exhibition is a showcase for engineering projects conducted by mechanical engineering students for their one year senior design class. All these innovative multi-disciplinary projects have been designed, developed, fabricated, and funded by CSULB and some local industries.



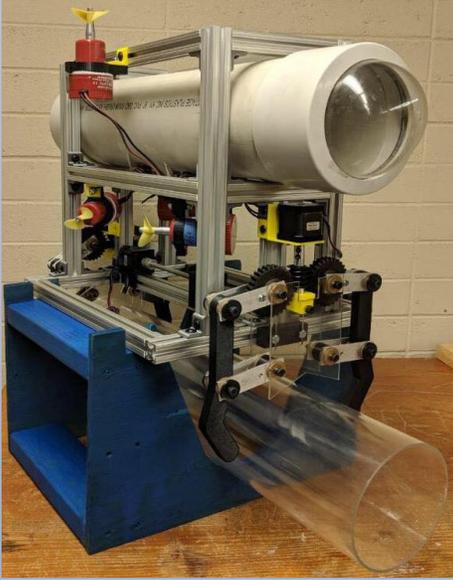
College of Engineering, California State University, Long Beach





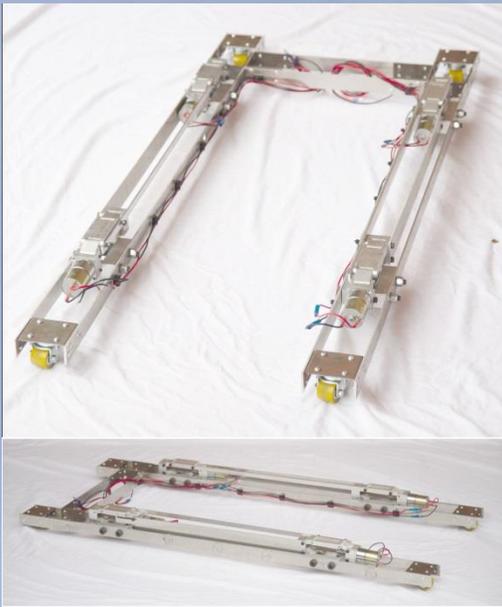
Harvesting energy from Long Beach waves

The Stairwave Generator is an overtopping device that utilizes incoming waves to convert water into usable energy. The device is made to suit the specifications of the Long Beach Breakwater. The goal is to maximize the optimum efficiency of the generator while keeping the device cost-efficient and safe for the marine life. Placing this device in the breakwater has many advantages such as minimal maintenance, availability of grid connections, and no potential need to include deep-water moorings or underwater electrical cables.



Underwater ROV for pipe inspection

The scope of the project was to create and manufacture an underwater ROV capable of pipe inspections. It is meant to have a lower cost than what is currently available in the market, as well as be versatile enough to be able to attach different adapters onto it to best suit a company's needs. SolidWorks, SolidWorks Simulation, Arduino, and Slic3r PE were used in order to model, test, and program the entirety of the project. The ROV main components are a functional linear actuator, gripper system, and bilge pumps (propellers).



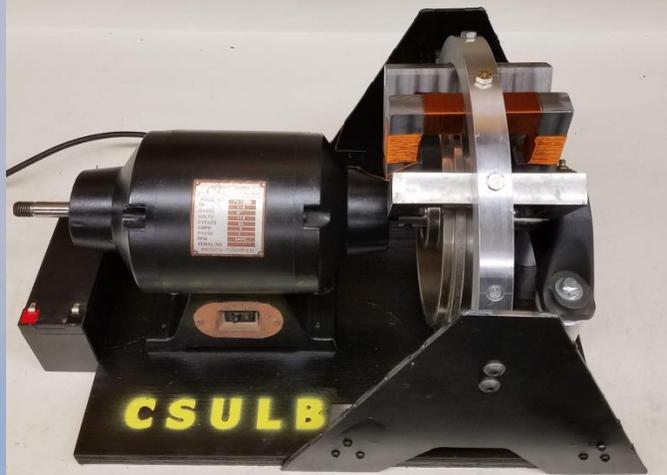
Automated parking platform

In densely populated areas like the city of Long Beach, space for parking is valuable and highly demanded. To mitigate this, research and resources are being shifted into the Automated Parking sector; robotic systems retrieve a user's vehicle from a drop off location, and transport the vehicle to a dense storage area. One of the main components in fully automated parking systems is the robotic platform for moving the car in the parking structure. This project demonstrates a cost effective innovative robotic platform in order to pick up and drop of a car at a specific location.



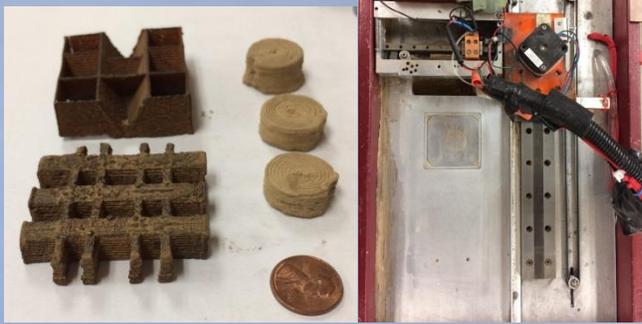
Thermite Fueled Power Plant for space

This small-scale power plant uses the natural resources of Mars to generate green renewable energy for a Martian colony during global dust storms. During these storms, current solar technology ceases to operate to generate life-saving power. No plan has been published to utilize the natural resources of Mars to generate power. This system uses Martian dust as an oxidizer in a fuel known as Thermite which burns at over 4000° F. The system will burn this fuel in a steam power plant to generate a theoretical power output equivalent to illuminating 395 modern LED lightbulbs.



Magnetic brake system for automobiles

Through the use of electromagnetic Eddy current brake systems on vehicles, friction, wear, and cost of maintenance can be reduced. The advantage of Eddy current systems over conventional friction braking systems is that they do not require contact between braking surfaces and can be modified and used for any type of vehicle. This paper describes the process through which a viable Eddy current brake system is developed, tested, manufactured, and documented.



Metal 3D printing by using salt solution

According to 2018 Wohlers annual report , in the last two years there have been an 220% growth in sales for AM machines that were capable to fabricate metallic parts. Therefore, developing a low cost process to fabricate high quality metallic parts is of high interest and is the direction of this project. In this project the process parameters for fabrication of Metal Matrix Composites by inkjet binder 3D printing was investigated. A preliminary research grade machine was adapted and modified to fabricate metallic parts from metal powder and inorganic salts. It was shown that this process can be adapted to develop a commercial grade metal 3D printer.



Phone charging station in bicycles

Cycle Cell is a system to harvest energy from the bike system with the intent to charge an electrical power bank. The design is powered by the rear wheel of the bicycle, and the energy from the bicycle wheel is transferred to a motor wheel. The energy collected within the motor will be routed to and stored in a detachable 500 mah power bank.

When the bike is ridden for about an hour the device collects energy and can charge a modern day cellular device for about 5 minutes - 10 minutes.



Optimization of overhead bins in aircraft

The goal of the program was to improve overhead bin designs in current aircraft interior cabins by working with the ZEO division of Zodiac Aerospace. The team utilized finite element analysis (FEMAP) and computer animated design (CATIA) tools to optimize the bin design. With ZEO funding and fabrication guidance, the team created and tested physical models to validate the analysis done with the computer models. Through FEA analysis, incorporating material changes, adding a hand force load distributor, and design changes to the front lip of the bin was found to increase the torsional stiffness performance.



Electrical can crusher system

Recycling is an important task that benefits people and the world itself. In 2006, 190-210 billion cans were consumed worldwide. In 2010, 56 billion cans were collected for recycling. Producing an aluminum can from recycled aluminum takes 95% less energy and produces 95% less greenhouse emissions. In this project a system has been created to encourage recycling as well as providing an efficient and fun apparatus for crushing aluminum cans. By crushing cans, consumers are able to increase storage space as well as have some fun seeing the systematic crushing of an aluminum container.



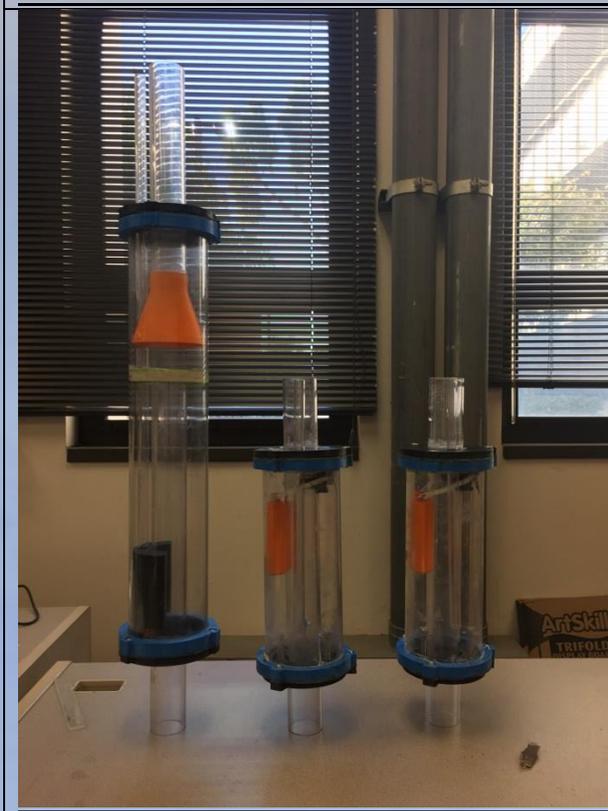
Multi-purpose collapsible skateboard

Longboards are used by many to go out cruising. Most of today's longboards have one purpose, which is to transport you from one place to another. This project adds a second function to a longboard, making it fold into a small seat by folding the deck into a tri-fold. In this prototype, hinges were used to make the longboard fold into a seat position, so the rider, preferably the youth, could have a place to sit down/rest if needed.



Harvesting energy from stove top

The generation of renewable energy is of major importance and demand today because of society's standard quality of life and its large consumption of energy. The Therm-o-Harvester is a system that harvests and reuses wasted heat using Seebeck's effect. The system's final design consists of various aluminum 6061-T6 parts, copper plates, and TEG Peltier modules. The system's goal is to create a large enough heat gradient on the TEG Peltier modules to generate energy which will then be stored in a battery for use



Extraction of Water from Gas Wells

There are approximately 1 million oil and gas wells currently producing worldwide and almost all of them rely some type of artificial lift system. One common challenge for gas wells is water build-up at the well's bottom. The current technologies in the petroleum industry, however effective they may be in removing water accumulation, hinder productivity in some way. The purpose of this project was to improve a current design of a new method for addressing the problem of water build-up in low pressure natural gas wells. The motivation for this project overall is to design a system that addresses water accumulation without restricting or hindering gas production in wells. The original design was successfully tested by Chevron Project Development and Execution Process (CPDEP). In summary, the strengths of this new proposed system are the following: It operates without an external power source, it uses no consumable chemicals, and it is a reliable mechanism.



Hybrid solar and wind energy generator

Power utility companies are rapidly moving away from fossil fuels towards renewables using either wind, or solar farms. The State of California has a mandate of achieving 50% of its power generation capacity using only renewables by 2030. Recent technological advancements in the field of materials for solar panels, and turbine blades, along with favorable operating economics is driving this push for more and more renewables.

In this project a robust and durable hybrid turbine have been developed to harvest wind and solar energy to produce electricity. The system can be used in places such as freeways, in-home use, ports and etc.

