MAY 3, 2024
CAL STATE LA
COLLEGE OF ENGINEERING,
COMPUTER SCIENCE,
AND TECHNOLOGY

Cal State LA College of ECST Capstone Senior Design

# ELECTRICAL ENGINEERING, MECHANICAL ENGINEERING, AND ENGINEERING TECHNOLOGY PROGRAM

## 2023-2024 PROJECT DESCRIPTIONS

### Project 101. SAE Baja Competition
### Off-road vehicle design and manufacturing

Client: Baja Competition Society of Automotive Engineers (SAE)
Advisor: Chris Bachman

Students: Alexis Alvarez, Aaron Augusto, Arturo Castaneda, Victor Galaviz, Herman Mateo-Pedro, Carlos Mendoza Magdaleno Quiroz, Tyler Romano



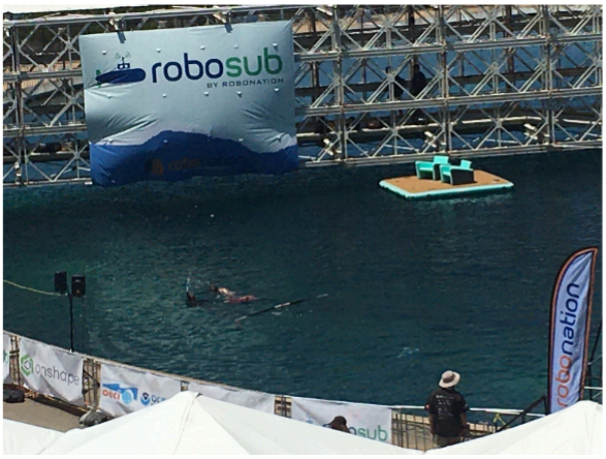
The Baja SAE Senior Design Team is optimizing the 4WD chain tension, modifying the weights and springs within the CVT, and designing a CVT cooling system. The senior design team will optimize the system through vehicle testing with instrumentation on the drivetrain system.

Background: The Baja Society of Automotive Engineers (SAE) Senior Design team, in collaboration with the current Baja SAE club, is tasked with the design and development of a four-wheel drive off-road vehicle that will compete against many teams from universities around the world. The Baja SAE competition is an event with various course challenges where teams from different schools put their engineering skills to the test and build off-road vehicles to compete with.

## Project 102. Robosub Competition
## Autonomous Underwater Vehicle Robotics Competition

Client: RoboNation Robosub Competition
Advisor: Mike Thorburn & Salvador Rojas

Students: Hector Campos, Justin Lu, Daryk Moreno, Jose Rangel




Design and integrate a robotic system to compete in the Robosub competition. The senior design team will design and build several components to be added to this year's submarines.

The Robosub Club at Cal State LA builds autonomous underwater vehicles (UAVs) each year for the international Robosub competition. In the competition, the UAV will be required to complete a series of tasks that may include detecting and passing through a gate, identifying and touching buoys, dropping markers, manipulating or deploying objects, and surfacing at desired locations.

---

## Project 103. ASHRAE Competition

Client: Sao Paulo, Brazil – Three-Story Structure with Basement-Level Library
Advisors: Chet Dik & Mohammad Shaikhsaheb

Students: Jose Barrales, Adolfo Jaimes Martinez, Randell Lamb, Adrian Rendon, Abdul Samayee, Jonathan Vo

ASHRAE
Shaping Tomorrow's Built Environment Today

The student design competition guidelines provide enough background information to enable the teams to design or select the HVAC system for the given building or to design a sustainable building by implementing an integrated building design process (the architectural and building design for sustainability and its supporting mechanical and electrical systems) for the given program.

The Setty Family Foundation Net Zero Energy Design competition aims to encourage students to extend their knowledge beyond the core mechanical systems. Mechanical and Electrical Engineers will work together to define the requirements for a building design. They will select their own equipment to create a Net-Zero design that helps create a center for the community while showcasing their knowledge of building requirements with assistance from the advisors.

---

## Project 104. ASME Unmanned Aerial Systems Competition
## Student Unmanned Aerial Systems Competition

Client: ASME Club (Salvador Rojas, ASME Club Advisor)
Advisor: Team 104A Bob Dempster
Advisor: Team 104B Mike Thorburn

Students-Team 104A: Lesley Camacho, Edwin Gutierrez, Abigail Martinez, Esau Trevizo, Joseph Vizcarra
Students-Team 104B: Daniel Aguirre, Santos Cabrera Lopez, Erick Carmona, Reuben Hill, Zain Malik, Emmedel Vargas



To build an autonomous drone to compete in the California Unmanned Aerial Systems Competition at Mojave Air & Space Port. The tasks may include aerodynamic structure design, telemetry, command and control system design, autonomous flight control, computer vision, package carry and dispense system design, and power and thermal systems.

---

## Project 105. 3D-Printed Fixed-Wing Aircraft Competition
## CSU 3D-Printed Fixed-Wing Aircraft Competition

Advisor: Everardo Hernandez

Students-Team 105A: Sam Carranza, Jesse Hernandez, Faraaz Khan Abir, Estefani Tayun Ajanel
Students-Team 105B: Alexis Amezquita, Javier Bravo, Daniel Mijangos, Jesus Terrazas Z
Students Team 105C: Luis Gutierrez Jr., Erik Ho, Lloyd Macauling, Luis Rivera
Students Team 105D: Alexander Arredondo, Audifred Espinoza, Alexander Lopez, Alan Tran
Students Team 105E: Abraham Ceja, Abigail Garcia, Jorge Hernandez, Jason Quinonez



In this project, students will design and fabricate airplanes using 3D printing technology. Given manufacturing and material constraints, the planes will need to be lightweight, and the designs will need to maximize performance. Student teams will leverage modern digital manufacturing technologies.

---

## Project 106. AcroBot – Robotic Trapeze Artist
## Exploring the Physics of Acrobatics with a "Stickman" Robot

Advisor: Kurt Sawitskas (Five Teams: 106A, 106B, 106C, 106D, 106E)

Students-Team 106A: Tiffany Chea, Abel Guillen, Norma Munoz, Caroline Oliveros, Edith Siordia
Students-Team 106B: Isaac Cuecuecha, Samuel Cuevas, Julieta Lemus, Ngoc Pham
Students-Team 106C: Jason Aguilar, Lud Gonzalez, Mario Melendez, Aldo Rojas, Karen Villatoro
Students-Team 106D: Oscar Gonzalez, Victor Nino, Justin Rojas, Erik Zelaya
Students-Team 106E: Robert Herrera, Christopher Macias, Norma Rangel, Ian Rutherford

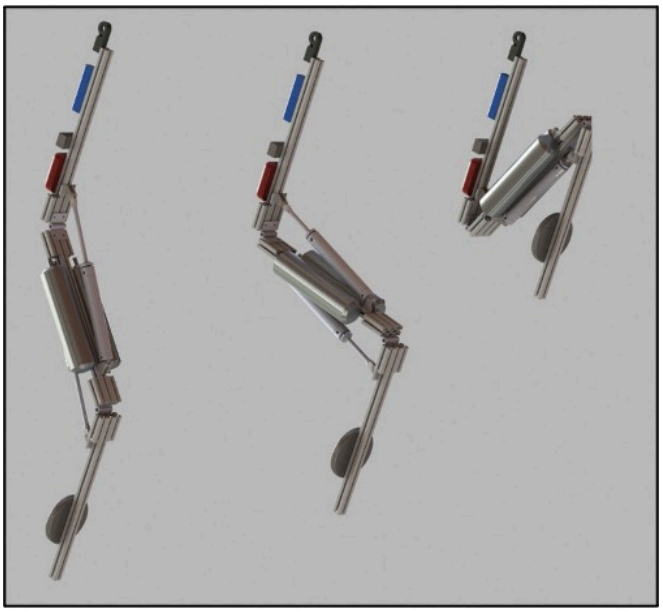


*Figure 1: Disney's Stickman Prototype. Later developed into the Spiderman Stuntronics figure.*

AcroBots are autonomous robots designed to perform specific acrobatic feats. Student teams will define, design, and produce a working AcroBot to perform a trapeze act. Students will master an understanding of the physics

involved and develop a robotic control system with sensors and actuators to perform an acrobatic trapeze stunt.

---

## Project 107. Project Channel Islands – Off Grid Solar System

Client: National Park Service (NPS) Channel Islands National Park
Advisor: Ted Nye

Students: Andrea Aguayo, Matthew Avila, Bao Diep, Enrique Lopez, Mulder Lopez, Nixon Lopez, Vickie Mallari, Sergio Polanco, Gerardo Rojas



The team will design, build, and deliver a new, modular solar power system to replace a water well electrical power system at Scorpion Cove on Santa Cruz Island. The system must provide enough power to run the water pump and auxiliary equipment and survive the island's harsh marine environment for 25 years. The team will deploy and install the system on the island in June 2024.

---

## Project 108. Electric Car Battery Development
## Model and test battery package for electric vehicles

Advisor: Masood Shahverdi

Students: Edjmin Carapetian, Kenneth Carrillo, Jose Garcia, Benjamin Geronimo, Raymond Tran, Richard Trieu

The project is a new student competition at Cal State LA aimed to design, build, test, and integrate an advanced EV battery pack into a production vehicle. Kicking off in Fall 2023, the three-year competition will provide an immersive, hands-on learning experience for students to gain valuable engineering, manufacturing, and battery testing skills that transcend the classroom environment.

The team will follow real-world industry milestones focused on battery design, simulation, controls development, testing, and vehicle integration and demonstration. Participants will also learn valuable project management, communications, teamwork, and problem-solving skills that will provide an unparalleled educational experience and prepare them for future careers in the battery industry.

Students will develop a test plan for cell characterization, collect test results, build digital models, forecast performance, determine pack requirements, including power, energy capacity, voltage, and architecture, and design and test state of charge and state of health algorithms.

---

## Project 109. Battery Development: Thermal Management

Advisor: Mario Medina

Students: Erick Gross, Mike Lim, Rigoberto Siqueiros, Omar Vaca, Ulysses Velazquez

The project is a new student competition at Cal State LA aimed to design, build, test, and integrate an advanced EV battery pack into a production vehicle. Kicking off in Fall 2023, the three-year competition will provide an immersive, hands-on learning experience for students to gain valuable engineering, manufacturing, and battery testing skills that transcend the classroom environment.

Teams will follow real-world industry milestones focused on battery design, simulation, controls development, testing, and vehicle integration and demonstration. Participants will also learn valuable project management, communications, teamwork, and problem-solving skills that will provide an unparalleled educational experience and prepare them for future careers in the battery industry.

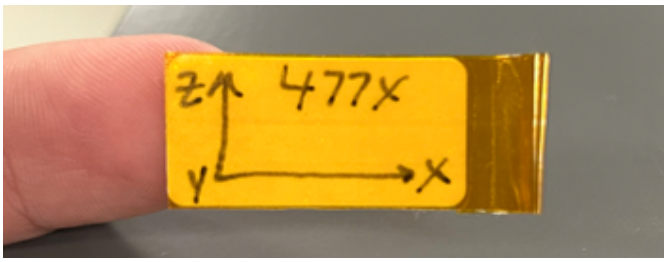
The student will design, build, and test a cooling system for a module-level battery pack. The team will perform trade studies for various cooling systems and adopt an appropriate strategy. Ideally, the team should validate their design choice with some analysis. They will find hardware and size components to reject heat while maintaining battery performance while considering packing and architecture. The end deliverable will be a working prototype of a robust cooling system. The system should be safe, reliable, and well-instrumented. There is an opportunity to work on simulation-based testing to complement the physical model.

---

## Project 110. Boeing Spot Tag Generator

Client: Boeing
Industry Liaisons: Teo El Masri and Jonathon Fish
Advisor: Patrick Hartunian

Students-Team 110A: William Alfaro, Gumaro Contreras, Ricardo Lino, Marley Morales, Diego Rojas
Students-Team 110B: Alexander Celis, Marco Frias, Jose Garcia Sandoval, Jonathan Martinez, Brayan Salgado




Develop a tool to generate spot tags and photo cards for all instrumentation defined in the Boeing satellite master instrumentation list. This requires the team to develop a computer program/script that takes information from our instrumentation list, creates the labels for each spot tag and photo card for all channels, and creates some sort of mechanism to apply Kapton tape to both sides of each spot tag (like the current spot tag design shown in the slides).

Spot tags and photo cards are used to identify accelerometer locations on satellite hardware. As such, they require specific orientation information and need to satisfy some spacecraft environment requirements, such as outgassing, so that they can remain in place through different test phases. Such a device has the potential for substantial efficiency improvements, as presently, the process is done by hand.

---

## Project 111. Aerospace Corporation On-Orbit Manufacturing

Client: Aerospace Corporation
Industry Liaisons: Aerospace Corporation

Students-Team 111A: Cuitlahuac Arenaza, Andrew Barajas, Albert Bernal, Joshua Keister, Sergio Munoz lechuga
Students-Team 111B: Ajax Alex, Agustin Esparza Garcia, Carlos Galdamez, Daniel Garcia, Itay Ramirez, Danny Valencia



Design a payload to be hosted about the BCT X-Sat Venus Class bus that will demonstrate a chain of three or more discrete operations that provide a capability important for on-orbit autonomous manufacturing in a vacuum. Deliverables shall include:

A conceptual design identifying the key payload elements & showing how the elements fit within the payload

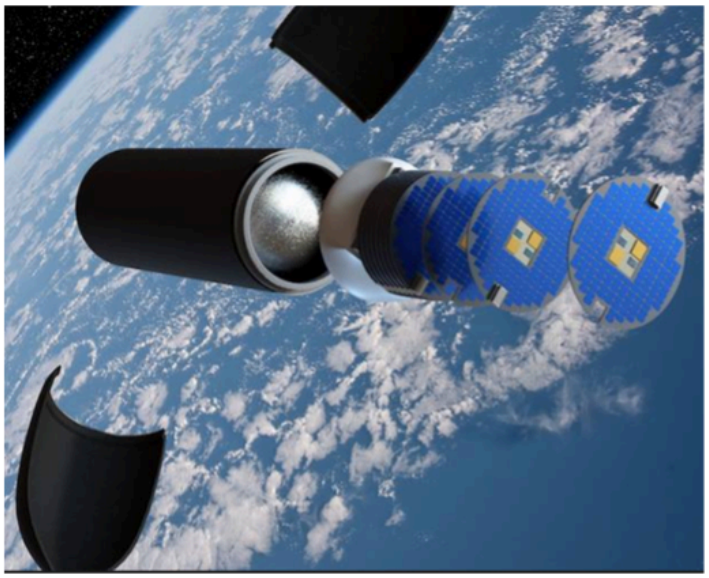
volume for launch. The Concept of Operations describes how the payload will be deployed & how it will perform the manufacturing operations. A prototype of at least one key element of the conceptual design

---

## Project 112. Aerospace Corporation: DiskSat Dispenser

Client: Aerospace Corporation
Advisor: Patrick Hartunian

Students: Oscar Carrillo, Peyton Chang, Angelica Chavez, David Escobar, Emil Golanians, Angel Olmos Saldivar, Gilbert Ramirez, Ian Ron, Scott Shum, Alejandro Vasquez Gonzalez, Gavin Vlietstra



Develop a concept for a DiskSat dispenser. Build a digital twin model of DiskSat and a separation system to inform the dispenser's design. Execute Monte Carlo separation analysis to show the concept's robustness to model uncertainties.

CubeSats have proven to be a low-cost, rapid acquisition platform for advancing the maturity of new space technologies. Demands for more power and instrumentation are set to outpace current CubeSat capabilities, which require larger deployable solar arrays. To cater to future demands, a scalable disk-shaped spacecraft has been proposed to provide the necessary surface area to accommodate additional instrumentation and solar cells. In order to release multiple DiskSats into orbit, a scalable dispenser with retention, release, and separation mechanisms is required.

---

## Project 113. Infrastructure Masons for a Digital Future

Client: Infrastructure Masons (iMasons)
Industry Liaisons: J. Albright, B. Kleyman, C. Popp (Advisors are all from iMasons)

Students-Team 113A: Gabriel Estrada, Abraham Hermosillo, Andrew Lindberg, Martin Perez
Students-Team 113 B: Chris Arellano, Leslie Cano Ochoa Huerta, Robert Itoh, Luis Martinez, Marvin Recinos




Students will work directly with iMasons to develop a detailed proposal and budget to build the digital infrastructure needed to meet the expected market demand for a new digital application in the U.S. The team will determine whether the client can justify building its own infrastructure. You will determine how many data centers to build, where, and when, and then design and cost one. Your proposal will need to consider latency and app response time to maintain the user experience, cost and scale (for example, number of cores) of the hardware, availability of fiber connection, availability and cost of power, availability and cost of renewable energy, land cost and availability, different approaches to heat rejection/management, facilities efficiency, flexibility in the event the market forecast is inaccurate, and resilience in the face of interruptions of power, fiber connection, natural disasters, pandemic, etc.

---

## Project 114. MathWorks Excellence in Innovation – Aggressive Maneuvers for Drones

Clients: MathWorks & Cal State LA Controls Lab
Advisor: Mike Thorburn

Students: Marino Di Franco Quinonez, Melody Hashemian, Alexis Moreno, Fergus Place



Performing aggressive maneuvers is a challenging control problem for UAVs that needs to be addressed for all applications where agile flying vehicles need to move with high acceleration and pass-through obstacles with a precise pose value that can approach singularity. Moreover, such control strategies will be necessary to overcome the hurdles caused by unexpected external circumstances – a strong gust of wind, relaunching from a failed vehicle landing, an obstacle disturbance in a cluttered space, etc. In this project, students design and

implement a non-linear control strategy that is able to deal with high disturbances and fast input variations and track complex trajectories using the tools that are used by the aerospace industry.

---

## Project 115. Product Design for LA City Department of Public Works – Sensor Deployment Structure for Automated Sidewalk Inspection System

Client: LA City Department of Public Works
Advisor: Kurt Sawitskas

Students: Juan Carrillo, Sandra Cisneros, Rommel Contreras, James Hoang, Javier Huerta, Alan Landa Maldonado, Armando Rocha, James Wang



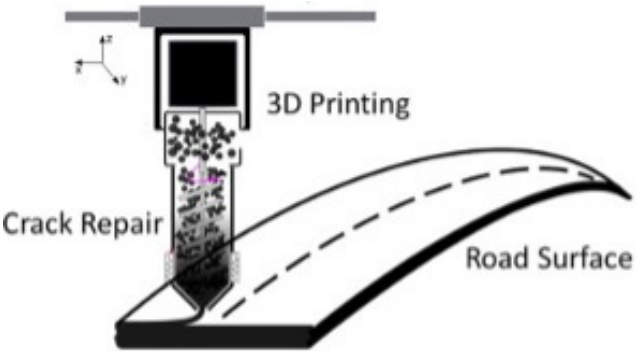
Design a mechatronic structure for the deployment and positioning of sensors as part of an automated sidewalk inspection system. The CS Department at Cal State LA has been developing an autonomous sidewalk inspection system for the LA City Department of Public Works for a few years. They have been focusing on the algorithms and the sensor data. At this point, they need a well-designed electromechanical structure to support the sensors in a predictable and controllable way. The structure needs to be reproducible, cost-effective, reliable, and maintainable. It will need to support multiple configurations and must have a configuration suitable for transportation and storage.

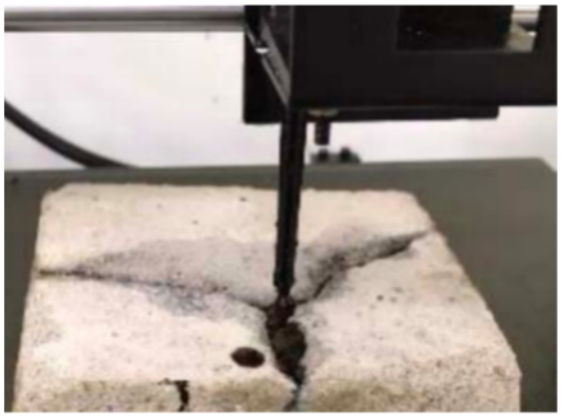
---

## Project 116. Innovative Asphalt 3D Printer
## Advanced Materials and Manufacturing Laboratory (AM2L)

Advisor: Dr. Mohsen Eshraghi

Students: Marcello Canova, Aaron Dixon, Nicholas Maldonado, Veronica Sifuentes, Joselyn Sosa Benavides



Repairing and maintaining asphalt pavements, bridges, walls, and other infrastructure components requires an efficient and precise method for applying crack sealant. Conventional techniques often lack accuracy, energy efficiency, and versatility, leading to suboptimal results and increased costs. There is a need for an innovative crack-sealing process that combines precise application, energy efficiency, and adaptability to various repair and maintenance scenarios. This senior design project brings together a dynamic team comprising 3-4 mechanical engineering students and 1-2 electrical engineering students to collaboratively design, construct, and validate a state-of-the-art asphalt 3D printer. This groundbreaking technology aims to revolutionize road repair and maintenance by utilizing advanced 3D printing techniques to create durable, cost-effective, and precise road patches and overlays.

---

## Project 117. Einstein Telescope (Gravity Waves) – Cryogenic Suspension

Advisor: Dr. Harry Themann

Students: Nelson Leon, Luis Ramirez Orozco, Marcos Santana, Mynor Soto, Fernando Velez



Design of new suspensions for the main test mass mirrors of the three Einstein Telescope cryogenic detectors. A collaborative design with several other young scientists and engineers worldwide. The design group will be doing REAL R & D with a worldwide collaboration of scientists and engineers. You will get to experience this world and learn to use cutting-edge simulation software. You will present results to the Einstein Telescope collaboration. You will compete with other groups; a successful design will be used in the telescope's construction.