

MONTEZUMA HALL | AZTEC STUDENT UNION MAY 8, 2015 | 1:00PM - 3:00PM

with special thanks to NORTHROP GRUMMAN

# WELCOME

Welcome to the College of Engineering's Spring 2015 Design Day at the Conrad Prebys Aztec Student Union. We are proud to have our undergraduate students showcasing their design project work completed during the Fall 2014 semester. There are teams representing our Senior Design classes in Aerospace, Civil, Construction & Environmental Engineering, Electrical & Computer Engineering, and Mechanical Engineering.

Please join me in congratulating our student teams on their innovative design projects which represent the culmination of the technical knowledge they have developed during their time at San Diego State University's College of Engineering. These projects provide the students with real-world project experience that involve design constraints, budgets, reviews, and deadlines. Through these projects our students learn to apply and develop their critical thinking skills, recognize human and societal needs, design novel, sustainable engineering solutions, and create value through their entrepreneurial efforts.

We are grateful to our many sponsors for their generous support of time and funding for these student projects, including among others Department of Energy, NASA, National Science Foundation, Northrup Grumman and San Diego Gas & Electric and Solar Turbines. Many of these sponsors are integrally involved with the student design teams and serve as mentors to the teams. This provides meaningful projects of value, and instills a professional orientation in the student teams. We appreciate all of our sponsors and their support for the student teams.

Enjoy SDSU's Spring 2015 College of Engineering Design Day. Thank you for being a part of this culminating event.

Monte M. Mehrabadi, Ph.D. Dean College of Engineering

SAN DIEGO STATE UNIVERSITY

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• SDSU ECE Senior Design Lab • Drs. Annellen and C. Alex Simpkins, Sr.

• Dr. C. Alex Simpkins • Thomas Marine, Inc.

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## **DESIGN, BUILD, FLY**

MEMBERS: Tom Hackleman, Jason Eakin, Brent Neely, Carlo Duya, Marlon Gerson, Adrian Diosdado, Nick Fritzler, Irving Hernandez, Marc Ruaburo, Ace Elacio, Rocio Hernandez, Edwards Siu, Chris Long, Javier Navarro, Carlos Mendoza, Kevin Navarro, Daneil Silva, Leslie Oropeza, Israel Lopez, Dylan Lauber, Dorian Andersen, James Mamuyac, Sabarrish Mohan, Artur Akopyan, Leah Ricci

ADVISORS: Dr. Nagy Nossier

SPONSORS: Northrop Grumman, Neu Motors, Neothings, Diversity Model Aircraft



#### AIAA - DESIGN BUILD FLY - SDSU

The AIAA through the Applied Aerodynamics, Aircraft Design, Design Engineering and Flight Test Technical Committees and the AIAA Foundation invites all university students to participate in the Cessna/Raytheon Missile Systems Student Design/Build/Fly competition. The contest will provide a real-world aircraft design experience for engineering students by giving them the opportunity to validate their analytic studies. Student teams will design, fabricate, and demonstrate the flight capabilities of an unmanned, electric powered, radio controlled aircraft which can best meet the specified mission profile. The goal is a balanced design possessing good demonstrated flight handling qualities and practical and affordable manufacturing requirements while providing a high vehicle performance. To encourage innovation and maintain a fresh design challenge for each new year's participants, the design requirements and performance objective will be updated for each new contest year. The changes will provide new design requirements and opportunities, while allowing for application of technology developed by the teams from prior years.

## **ROCKET PROJECT**

MEMBERS: Immanuel Marinas, Reid Hallett, Arlindo Bork, David Chance, Daniel Silva, Travis Wyatt, Austin Menesez, Sabarrish Mohan, Noah Nutter, Josue Quinonez, Jacbon Dodson, David Mac Wrenn, Mckenzie Melcher, Ryan Callahan, Kyle Shubert

ADVISORS: Donovan Geiger, Carl Tedesco

SPONSORS: Flometrics, Virgin Galactic, Northrup Grumman, Friends of Amateur Rocketry, HackHD, San Diego Composites, Solar Turbines, NASA, National Instruments, ASME, NetBurner, Golden State Cellular



#### **GALACTIC AZTEC**

The objective of the Rocket Project is to further enhance the education of Engineering students with hands-on design/fabrication pertaining to aerospace related projects. Our current project, the Galactic Aztec is being designed and fabricated by five Lead Engineers: Airframe, Fins, Recovery, Electronics, and Plumbing. The Galactic Aztec is project to have a maximum burn time of 22 seconds equal to a maximum total impulse of 22,000 lbf-sec, taking the organization to an all-time high of 34,000 ft. Upon successful recovery, the Rocket Project will move to developing a two stage-rocket in the upcoming school year. Students gain the experience of developing a Rocket Launch Control System along with its own Data Acquisition. To ensure a successful flight, students aim to design and fabricate supersonic fins.

## SDSU WATER TUNNEL STUDENT TEAM

MEMBERS: Tom Hackleman, Marlon Gerson, Pierre Boucquey ADVISORS: Dr. Xiaofeng Liu



#### SDSU WATER TUNNEL

The SDSU Water Tunnel will facilitate cavitation research at the University for decades to come. The tunnel holds a total of 750 gallons moving at 660 gallons per minute, and can be pressurized up to 75 PSI. The test section is designed to utilize the cutting-edge in Particle Image Velocemetry (PIV) technology, and will be used to study such topics as cavitation and turbulence. The team was required to work in a wide range of fields including design, flow analysis, structural analysis, electrical, system integration, manufacturing, optimization, and budgeting.



## ASC ENGINEERING

MEMBERS: Christopher Ramos, Joe, Richard Moreno, Dwight Ashman, Jason Bell, Sean Mosch ADVISORS: David Edwards, Sam Amen



#### SR-67 HIGHLAND VALLEY ROAD ROUNDABOUT

This project discusses the beneficial impact to adding a roundabout on the intersection of Highland Valley Road and SR-67. The project takes careful consideration to the impact to the current traffic condition, the environment, the cost to the city and most importantly, the community of Ramona City.

## ASSAB ENGINEERING & CO.

MEMBERS: Brittney Shamoun, Sarah Ashkanani, Amer Al-Daraghma, Saleh Alasoousi, Abdulrahman Al-Houqal



#### SR-67 & HIGHLAND VALLEY ROUNDABOUT

The purpose of this project is to improve traffic flow on State Route 67 with the design and production of an effective roundabout. An effective roundabout assists and accommodates the flow of vehicles with both safety and efficiency. This project entails three main disciplines, Transportation, Storm Water/Environmental Engineering, and Construction Engineering. Excessive speeding subsists which creates dangerous conditions for pedestrian crossing. High queuing anticipation from frequent drivers on the road continues to threaten the safety of all. Several stopped vehicles exist in current driveways, intersections, and blind curves causing a high number of accidents. We will be able to improve the conditions of the road with functionality and safety factors. This roundabout design shall fulfill all of the necessary requirements.

## BHMP

MEMBERS: Blain Katz, Hazem Serour, Miguel Cruz, Phil Veleker ADVISORS: Sam Amen - CalTrans



#### SR-67 & HIGHLAND VALLEY ROAD ROUND-ABOUT

The intersection at Highway 67 & Highland Valley Road in Ramona has become a headache for drivers during the morning and afternoon commutes. The current level of service at the intersection is below standards and unless something is done conditions will continue to worsen. Our goal is to provide an alternative design by replacing the current four way traffic light system with a roundabout capable of increasing traffic flow while providing aesthetic value to the area.

## **BLACK IRON CONSULTANTS**

MEMBERS: Colby Blakeman, Adam Brooks, Chelsea Feeney, Bryce Quigley, Tyler Sevcik ADVISORS: John Prince, P.E. - Michael Baker International



## SAN DIEGO MIRAMAR COLLEGE PARKING STRUCTURE 4

The San Diego Community College District has commissioned the design and construction of an additional parking structure titled "Parking Structure 4" located at the Miramar Community College in northern San Diego County, California (10440 Black Mountain Road, San Diego, CA 92126). The purpose of the new parking structure is to provide additional parking in order to relieve traffic and parking congestion around campus while, during the design process, consider space efficiency, total cost, and the overall lifecycle of building materials and systems so as to minimize the required maintenance. The given constraints and considerations have provided unique challenges and opportunities for our team to produce innovative alternative solutions to meet the demands of the project.

## CALCON

MEMBERS: Collin Weisenburger, Jacob Juhler, Ronald Diaz ADVISORS: Sean McCarty, Jim Lewis, John Prince



#### **DEL MAR SEWER FM**

CALCON's main focus of the project is to provide Design-Build services for the City of Del Mar/Solana Beach Joint Venture. CALCON will analyze the predicted flow of the pipeline with an interest in minimizing construction impact on the two Cities. Cedros Avenue is a very popular tourist/shopping area that provides a unique aspect to Solana Beach. Minimal construction impact, especially in the summer months, will reduce the financial and cultural allure that this area provides to the people within Solana Beach. This populated area adds a challenge to the project, but with a focus on scheduling and proper analysis of the area, CALCON can reduce impact. CALCON will be providing a detailed schedule for construction of the force main, a construction estimate for overall cost of the project, and an analysis of the flows of the forcemain to provide adjustable peaks for San Diego, as well as, constant flow to SEJPA.

## **CIVIL-SEISMIC CONSULTANTS**

MEMBERS: Vanessa Tarronas, Kyle Schellenger, Chris Yamaguchi, Emerson Revolorio, Patrick Poon, Robert Kochan

ADVISORS: Dr. Robert Dowell, Chris Vonk - Ninyo and Moore



## EARTHQUAKE ENGINEERING RESEARCH

Civil-Seismic Consultants were hired to design a 20-story highrise structure in La Jolla. The location will require demolition and will be replaced with the proposed structure. The design of the structure is based on the balsa wood design for the Earthquake Engineering Research Institute Undergraduate Seismic Design Competition. The structure is designed to withstand several earthquakes that are similar to the tests from the Seismic Design Competition. The difference between the design competition and this project is that the Civil-Seismic Consultants does not only include a structural section, but also geotechnical, environmental, and construction.

## **DIRTY DOGS**

MEMBERS: Grant Fernando, Aman Mohammadian, Dennis Obtera, Paul Diaz, Clifford Montgomery ADVISORS: Rik Becker - Berg Electric, Shawn LePine - Berg Electric



#### **VETERANS HOME OF CALIFORNIA, FRESNO**

The project is a housing and residential care development. It is located in Fresno, California. The project sits on thirty acres. It will have 300 beds, assisted living, and skilled nursing care. Amenities to include a multi-purpose room, salon, banking services, religious services, Library, and therapy center.

## DRY WATER ENGINEERING

MEMBERS: Andrew Dunavent, Jason Andres, Kenneth Santos, Juan Parra, Tiancheng Xu ADVISORS: Jim Rasmus, P.E., BCEE, ENV SP - Black & Veatch Corporation



#### **URBAN DRY-WEATHER WATER HARVESTING**

With increasing amounts of dry-weather runoff in urban areas, contaminants and water is leaking into Los Peñasquitos Creek. The goal of our project is to divert the contaminated run off water to pump station #65 where it will then be pumped to the North City Water Reclamation Plant and used for recycled water. What would normally be water that would end up in the lagoon, is now recycled water that will aid in the severe drought that California is in. In addition, a new source for recycled water, the contaminated runoff that is diverted helps keep additional pollution out of the environment, leading to a healthier and more sustainable watershed.

## **DVA & ASSOCIATES**

MEMBERS: Christian Aguilar, Michael Dunne-Vecchio, Daniel Diaz, Daniel Lopez, Elizabeth San Pedro, Rudy Zelaya

ADVISORS: John Prince, Stephen Manganiello, Mauro Nebreja, Stephen Cook, Phuong Nguyen SPONSORS: City of National City, Chen-Ryan Associates, Sage Project SDSU



#### **EI-TOYON BICYCLE ROUTE**

The El-Toyon Bicycle Route is a subset of the National City Bicycle Master Plan Capital Improvement Plan. In 2014, an Active Transportation Grant was awarded to National City, CA for the El-Toyon Bicycle Route. National City is a dense, urban community and in order to best aid the residents the city-wide integration of safe bicycle transportation is vital. It will aid in the safety, sustainability, and convenience of the entire community. The El-Toyon Bicycle Route will provide a segment of the city's overall bicycle infrastructure, connecting public schools and different community areas. Overall the plan is to redevelop the existing bicycle path infrastructure as well as create a new corridor for safe bicycle travel. The overall goal of the project is to create a safer, resourceful, and aesthetically pleasing environment for the residents along the proposed corridor.

## **ENKI ENGINEERING**

MEMBERS: Michael Prowant, Mark Burt, Nick Siracusa, Marlen Cervantes, Darin Sanchez, Josh Papas ADVISORS: James R. Haughey, P.E.



#### LINDO LAKE WATERSHED QUALITY PLAN/ COUNTY STORM DRAIN ANALYSIS

Lindo Lake has been filling with sediment from the surrounding watershed for years. The western section of the lake is fed fresh water via pumps, but the eastern portion receives its water only from storm water runoff and rainfall. A watershed management plan is being developed and will include recommendations to improve existing storm water systems as well as future improvements to facilitate the revitalization of the lake. Additionally, a decision making computer program is being created to assist the county in prioritizing storm pipe rehabilitation or replacement. The program will allow the user to quickly see available storm water pipe options available for each unique location by entering in data specific to where the pipe will be installed.

## **EUREKA CONSULTANTS**

MEMBERS: Elizabeth Anderson, Gary Frankhauser, Matt Madril, Greg Dunn, Patrick Larkin, David Willis ADVISORS: Michael Greer - Dokken Engineering, Lima Saft - Caltrans, James Haughey (Michael Baker International



#### SR-67 AND HIGHLAND VALLEY ROUNDABOUT

This project involves the reconfiguration of the intersection of Highland Valley Road and State Route 67 within the City of Ramona. Current traffic conditions are problematic, as they create a daily backup that extends miles beyond the intersection. In order to improve flow, a roundabout will replace the signalized four way stop. Another problem faced by the current conditions is safety, and the proposed roundabout will alleviate many accidents generally seen in a four way intersection. In addition to a new design, the roadway will also be updated to meet current standards and further improve the area.

## **FULL CIRCLE ENGINEERING**

MEMBERS: Nick Moss, Mario Flores, Miguel Arciniega, Fadi Elkassis, Lioneil Lumido, Chris Frank ADVISORS: Sandy Brady, Senior Civil Engineer Capital Improvement Program, County of San Diego



#### SR-67 AND HIGHLAND VALLEY/DYE RD ROUNDABOUT

California SR-67 and Highland Valley/Dye Rd intersection is situated on the outskirts of Ramona, CA. The site is one of the few major arteries that connect Ramona and further Northern cities with South San Diego County. The old design of the intersection is no longer functional. Traffic queueing occurs on a daily basis during peak hours effecting the safety of automobile, pedestrian and equestrian traffic. This roundabout design incorporates all three of these parameters of safety to provide a level of service acceptable over the next fifty years.

## JDB CONSTRUCTION

MEMBERS: Jacob Scheidel, David Rodriguez, Brandon Ballard ADVISORS: Joe Buckley, Granite Construction Project Manager, Dr. Takis Mitropoulos



#### CARSON CITY AIRPORT MAIN APRON RECON-STRUCTION PHASE III

The work includes the reconstruction of 17,050 square yard of existing pavement and constructing miscellaneous drainage improvements at the Carson City Airport. The project includes earthwork, 6-inch aggregate base course, 4-inches of asphalt concrete, 9-inch Portland cement concrete pavement, saw cut control joints, 24-inch concrete encased slotted drain pipe, installation of tie-down anchors, and pavement striping. The project will also include a baseline schedule, cost estimate, Storm Water Pollution Prevention Plan (SWPPP), traffic control plan, QC/QA plan, PCC exhibit (Re-Design), phasing plan, temporary structures design, and excavation drawings and calculations.

## JJ SAAM ENGINEERING

MEMBERS: Madeline Downing, Austin Clark, Juan Sanchez, Salvador Sanchez, Angelo Pallotto, Jack Ohanian

ADVISORS: Sam McWhorter - Kimley-Horn



#### PARADISE CREEK IMPROVEMENTS PROJECT

The goal of this project is to improve the storm water infrastructure, pedestrian safety and connectivity, and the naturalization of Paradise Creek in the areas of National City surrounding Kimball Elementary School. Due to dated infrastructure, the area of interest is subjected to extreme flooding as the result of: a) heavy rain which exceeds the design criteria for the current storm water infrastructure, and b) unexpected high tidal flows which causes water from the local bay to run in the opposite direction of natural flow down the creek.

#### **KMT**

MEMBERS: Kasha Figuera, Tanis Bernier, Keith Galligan, Matt Gessner, Isiah Mit Thanananat ADVISORS: Nicholas Abboud, TE from City of San Diego - DSD, George Schuh - CalTrans, Scott A Johnson, CE from City of San Diego - DSD



#### SR-67 HIGHWAY AND HIGHLAND VALLEY ROAD ROUNDABOUT

This project is to improve the traffic flow at the intersection of the 67 SR Highway and Highland Valley Road located in Ramona. This particular intersection is towards the North end of the state route where traffic accumulates heavily. Our design is a roundabout for this area. This has become a widely popular alternative to increase traffic flow. The roundabout will be set up for speeds of about 25mph from all four directions of travel. This will not be controlled by stop signs or a traffic signal, and it will reduce speeding and the number of accidents in this area. Ultimately, this roundabout will reduce congestion and increase safety where these two roads meet.

## **NECA GREEN ENERGY CHALLENGE**

MEMBERS: Keith Walsh, Scott More ADVISORS: Dr. Thais Alves, Karen Prescott SPONSORS: NECA San Diego



#### **NECA GREEN ENERGY CHALLENGE**

The Green Energy Challenge is a student competition in which universities across the country compete by designing an energy retrofit of an existing facility. The project that our team chose is San Diego Zoo. We will be dedicating our contracting/consulting services to create a centralized microgrid and power storage system for the facility. We will be conducting an audit of the power and lighting systems and developing a plan to centralize power management and accrued charges during off peak hours. An economic analysis will also be done in order to understand how these upgrades will offset energy costs and provide savings to the client. In addition, our team will reach out to the students of a local high school in order to spread awareness of energy consumption and strategies to reduce waste. The potential savings for this project is immense and Aztec Energy is excited to deliver the proposal to the client.

## **TANJEN ENGINEERING**

MEMBERS: Eric Thiebaud, Nick Popaditch, Toan Nguyen, Jesse Felten, Nick Neinast, Abraham Diaz ADVISORS: Jim Haughey, P.E., Sameh Amen, P.E.



#### SR-67 HIGHLAND VALLEY ROUNDABOUT

Our project's purpose is to design a roundabout to replace the current Highland Valley/State Route 67 intersection, with the goal of eliminating congestion entering the intersection and to reduce delays for drivers heading in and out of the Ramona area. Our solution will provide a practical and economical roundabout design that will significantly reduce congestion during peak hours.

## VELOCIRAPTOR ENGINEERING

MEMBERS: Joe Iacovera, Shannon Lewis, Ernesto Quintero, Jose Mendez, Gerald Chacon ADVISORS: James R. Haughey, P.E. LEED AP





#### SR-67 & HIGHLAND VALLEY ROUNDABOUT

The SR 67 & Highland Valley Road intersection in Ramona, CA encounters high volumes of traffic during its peak hours. The intersection becomes congested and traffic gets backed up significantly in all directions. Due to the excessive queuing and some speeding issues, safety for pedestrians and frequent drivers is a necessity. In order to improve the flow of traffic at the SR 67 & Highland Valley intersection, the County of San Diego would like to consider a roundabout design for the intersection. The scope of the project includes: preparing a traffic study, improving pedestrian crossings, performing a storm water analysis, preparing plans, specifications, and estimates (P, S, & E), and preparing documents for a Caltrans Encroachment Permit.



#### ALIA-AUTONOMOUS LINE INSPECTION ASSISTANT-FLIGHT TEAM

MEMBERS: Rodney Corrigan, Drew Smith, Joanna Avita, Daniel Culler, Jason Wilmoth, Jorge Romo, Alejandro Castro

ADVISORS: Alan Dulgeroff, Steven Prsha, Daniel Smith

SPONSORS: San Diego Gas & Electric



### ALIA-AUTONOMOUS LINE INSPECTION ASSISTANT

ALIA is an autonomous quadcopter with the ability to equip two different payloads that allows it to capture high definition video, infrared imaging, line current measurements, and the generation of topographic maps. The quadcopter will wirelessly transmit telemetry data, which includes the current measurements, to an OSI Pi database for inspection record keeping.

#### ALIA-AUTONOMOUS LINE INSPECTION ASSISTANT-SOFTWARE TEAM

MEMBERS: Fadi George, David Quan, Marc Gagui, Craig Urich, Chris Parsoneault ADVISORS: Alan Dulgeroff, Steven Prsha, Daniel Smith SPONSORS: San Diego Gas & Electric



#### ALIA-AUTONOMOUS LINE INSPECTION ASSISTANT

ALIA is an autonomous quadcopter with the ability to equip two different payloads that allows it to capture high definition video, infrared imaging, line current measurements, and the generation of topographic maps. The quadcopter will wirelessly transmit telemetry data, which includes the current measurements, to an OSI Pi database for inspection record keeping.

## **BITS N' OHMS**

MEMBERS: Reylen Ramirez, Brian Murphy, Aitor Gonzalez, Michael Manglicmot, Jefferson De Leon ADVISORS: Dr. Gordon Lee

SPONSORS: Electric and Computer Engineering Senior Design Lab



#### SAE AUTONOMOUS WALKING ROBOT

To design, build, and test a small autonomous robot capable of traversing a flat surface with walls and obstacles as well as climbing stairs to reach the target location. The robot will consist of an embedded controller, sensors, servos all mounted on a chassis. The controller will drive actuation with the use of servos and shall receive feedback from the sensors to correct its path in the case of an obstacle or traverse a set of stairs to reach its destination. The design will meet the specified dimensions of no larger than 7"x7"x7" and will have full autonomy.

## **E-CUBED**

MEMBERS: Eric Aquino, David Brooks, Nick Fileccia, Matthew Mummert, Edward Palma ADVISORS: John Kennedy

SPONSORS: Electrical and Computer Engineering Senior Design Lab



#### MICROMOUSE

A micromouse is an autonomous maze-solving robot capable of mapping and solving a 16 by 16 cell maze. Our goal is to fabricate a mouse designed for competition. The mouse's data-processing algorithm is able to generate the quickest and most efficient route to the center of the maze. The mouse will feature two modes to be used during competition. The "Discovery Mode" will map cells onto an array which will then be processed to output a string of commands for the mouse to reach the goal. In "Fast Run Mode," the mouse will execute this list of commands at high speed. We will be using an ARM Cortex as our microprocessor that will control all of our peripheral equipment. Computer intelligence will utilize a modified flood-fill algorithm. Wall sensing will be handled by five pairs of 940nm infrared emitters and receivers, a pair of 30:1 DC motors equipped with paddle-wheel encoders capable of closed-loop error handling which will handle forward thrust and turning motions. Our team is dedicated to designing SDSU's first complete micromouse.

#### **NOVAS-NURSING AND OUTPATIENT VIDEO ACCESS SYSTEMS**

MEMBERS: Waleed Alabdulhadi, Aaron Penne, Robert Morris, Faisal Alyouhah, Benjamin Crabtree, Jonathan Crouch, Nathan Saft, Khalid Alageel

ADVISORS: Hugh Molesworth

SPONSORS: West Health Institute



#### **NOVASCREEN**

The NOVAScreen is a two-way video link with no touchable controls that will allow a home-based senior to communicate effectively with a remote nurse practitioner. The purpose of this project is to create home care medical assistance that will help lower health care costs and avoid unnecessary ER visits for the senior.



## QUADRATUS

MEMBERS: Eric Bergstedt, Kenny Doan, Va Linh, David Martinez, Marc Villanueva ADVISORS: Dr. Gordon Lee

SPONSORS: Electrical and Computer Engineering Senior Design Lab



#### AUTONOMOUS WALKING ROBOT PROJECT

Our goal is to design a robot that is able to navigate a grid and climb stairs autonomously. The robot must be able to fit within a 7x7x7 inch cube and we must build it using \$300 or less. We chose to design the robot using four legs to walk and infrared sensors to determine the distances of the obstacles.

## **RABBIT TRAILS**

MEMBERS: Dustin Sackett, Adam Tuley, Zhepeng Hong, Derek Mack II, Yadira Arevalo, Jimmy Doan ADVISORS: Dr. Gordon Lee

SPONSORS: Electrical and Computer Engineering Senior Design Lab





#### WALKING ROBOT COMPETITION

Our project is to design a robot that is able to navigate itself autonomously through a course that includes stairs and obstacles that our robot will have to avoid in order to make it to the exit of the course. Our team will have to use an array of mechanical, electrical, and computer engineering skills to complete this project including but not limited to: 3D CAD modeling and drawings, CNC fabrication, PCB design and layout, power supply definition and design, sensor utilization, microcontroller programming- servo control, walking logic, navigating logic, wall avoidance, stair recognition, etc.

## **SDSU MIGHTY MOUSE**

MEMBERS: David Phan, Albert Fruner, Brian Lieu, Brain Snow, Tareq Esmail, Mai Chao Her ADVISORS: John Kennedy

SPONSORS: Electrical and Computer Engineering Department



#### MICROMOUSE

Micromouse is a robotic maze solving competition held by IEEE. The mouse must find the center of a 16x16 maze in the shortest time possible. SDSU Mighty Mouse's objective is to design and build a robot capable of finding the center of the maze in the shortest time. Our autonomous mouse has speed, accuracy, and precision to give it the most optimal performance. Running on an enhanced Modified Flood Fill Algorithm, our mouse can intelligently maneuver from to cell to cell and find the center within less than the required 10 minutes.

## **TEAM BLACK MESA**

MEMBERS: Sherwin Edquiban, Nguyet "Vicky" Vo, Drew San Vicente, Craig Lewis and Petar Tasev ADVISORS: Dr. Gordon Lee

SPONSORS: SDSU



#### AUTONOMOUS WALKING ROBOT

Our goal is to design, build and test a 7" x 7" x7" robot that is able to autonomously navigate through an obstacle course that is made up of walls and stairs. As opposed to buying a pre made walking robot, we decided to design and fabricate one ourselves via Solidworks. Our robot has four legs and is made up of servos, infrared sensors, a battery, a voltage regulator as well as a microcontroller all assembled onto its chassis.

## **TEAM DASHBOLT-HARDWARE**

MEMBERS: Saoud Al-Heidous, Anthony Ayento, Aaron Delgado, Calvin Gonzales, Brandon Hunt, Danh Hy, Sergio Sarmiento, Erwin Tan

ADVISORS: Neil McLellan



#### INTERNET OF THINGS ELECTRIC "SMARTBIKE"

For the hardware side, we are tasked with integrating sensors in and around an electric bike courtesy of Bolt Motorbikes that measure various points of data such as battery temperature, individual battery cell voltage, rider's weight, and whenever buttons are pressed on the bike. We also designed a battery management system that will intelligently charge individual cells of the battery to prevent any damaging effects of overcharging and overdischarging its operating voltage. The sensors will be fed into an under seat microcontroller, the Intel Edison. The Edison will track all the data coming in and push it out to an Android enabled phone placed on the handlebar of the bike via Bluetooth connection. From the Android phone, the data will be pushed to Wind River's Cloud solution, Wind River Edge Management System.

## **TEAM DASHBOLT-SOFTWARE**

MEMBERS: Camille Anne Afalla, Jacob Cao, Ardian Kuqi, Rafael Reyes, Cristian Rivera, Jim Tran ADVISORS: Neil McLellan

SPONSORS: Wind River



#### INTERNET OF THINGS ELECTRIC "SMARTBIKE"

Data captured from sensors fitted on an electric bike provided by Bolt Motorbikes is sent to an Android-based smart phone through Bluetooth connectivity from an Intel Edison board that acts as the bike's central sensor network hub. The phone is loaded with an application created by our team that takes the data and displays them in a user-friendly user interface (UI). The phone is attached to the bike on a phone cradle and serves as the dashboard of the bike, displaying current speed, charge of the battery, and location on a map. The app has other features including graphical representations of the sensor data, which aids in data interpretation for maintenance purposes, and access to music applications.

## **TEAM NAVI**

MEMBERS: Daniel Lapuz, Landy Chan, Anthony Ortiz, Bruce Le, Victor Nguyen, Justin Mateo ADVISORS: John Kennedy

SPONSORS: Electrical and Computer Engineering Senior Design Lab



#### MICROMOUSE

We will design an autonomous mouse that will navigate through a 16 x 16 unit square maze to find the center. Our micro mouse will be able to map the maze finding any path to the center. Once the maze has been mapped, our mouse will calculate the fastest path to the center based on the routes it took. It will be constructed according to the official rules of the IEEE Micromouse Competition, which includes a maximum price range, a restriction on size of the robot, and that it may not touch a wall. Our finished micromouse will implement the code to solve the maze within the given time limit of 10 minutes.



## **3D REVOLUTION**

MEMBERS: Cory Beeghly, Jason Perrucci, Ryan Taylor ADVISORS: Dr. C. Alex Simpkins





#### **REDUCED OSCILLATION 3D PRINTER**

The goal of the project was to design a cheap, open source 3D printer that uses counterweighting in the gantry to reduce overall vibration and oscillation within the system. Vibration and oscillation are one of the main factors that reduce the speed and accuracy of 3D printers in the marketplace today. By using counterweights that counteract the motion of the gantry theoretically the oscillation should be reduced.

## AETD

MEMBERS: Megan Lacy, Craig Larwood, Morgan McNamara, Robert Newcomb, Kristi Nishihira ADVISORS: Kyongmi Um, Ph.D., Postdoctoral Fellow, The Salk Institute SPONSORS: Dr. C. Alex Simpkins, RDPRobotics



#### ASSISTIVE EXO-THUUMB DEPRESSOR

We augmented thumb strength through mechanical transmission to reduce skeletal and muscular stress of the hand and wrist experienced during pipetting. With a light-weight and ergonomic design, our product can read the amount of force being applied by the user, and is able to calculate the additional force needed to fully depress a pipette. Our product then mechanically assists the user to apply the needed force to pipette through a motor-driven cabling system.

## **AZTECATRONICS**

MEMBERS: Bryan Grove, Kent Kurashima, Maxwell Rooney, Riley Winship ADVISORS: Dr. C. Alex Simpkins SPONSORS: Dr. C. Alex Simpkins, RDPRobotics



#### **ROBOTIC DIGITS**

The goal of this project is to create a reconfigurable robotic finger system that replicates the movement and positioning of a human finger. To meet the goals of this project the design must also have a low manufacturing cost and a simple assembly process while maintaining a low cost. The product should maintain a durable yet sensitive structure. Human fingers are very complex and have therefore been challenging to replicate robotically.

## **BAJA SUSPENSION TEAM**

MEMBERS: Christian Serna, Nina Amiri, Faris Saab ADVISORS: Dr. C. Alex Simpkins SPONSORS: Dr. C. Alex Simpkins



#### NEW SUSPENSION SYSTEM FOR SDSU SAE BAJA CLUB CAR

Each year several SDSU Mechanical Engineering students design and fabricate an off road go cart to race in an annual intercollegiate competition well known as Baja SAE. Varying conditions from sand, mud, rocks and other obstacles punish race cars to their limits. Event officials grade performance of cars on different aspects, the most relevant for us, is the suspension and traction test. As part of our senior design project we are required to re-design a new suspension system for the car. Our goal is to improve on the previous year's design which had several issues leading to the SDSU team finishing78 out of 95 participants. Some of the relevant problems that the suspension had in the previous year were a first rear trailing arm over extending during down travel causing excessive transverse shear force on the rear axle. Second, lower rear support bars rubbing on CV-boots, resulting in breakage of one of the axles during the endurance event. As well, the rear shock absorber did not travel in a linear motion causing the car to have an aggressive behavior during jumps and an unstable feel while turning. On the other hand, the right side trailing arm was hitting in a section of the chassis during compression stroke, consequently affecting even balance of the car.

## **BASS FLAME TRACKING**

MEMBERS: Grayson Lange, Kristine McGrath, Macarena Rey ADVISORS: Dr. Subrata Bhattacharjee



### REAL-TIME FLAME IDENTIFICATION, TRACKING & ANALYSIS

In pursuit of understanding the flame behavior in space, experiments are also being run on Earth in order to potentially find a correlation between the burning behaviors, such as flame spread rate. Traditionally in the pursuit of stabilizing a flame, a thermocouple has been used to try to use the temperature of the leading edge of a flame to maintain the relative position of the flame. This project is aimed to verify the validity of using a device that contains a radiometer comprised of a thermopile to achieve the same goal with more precision than previously attained with a single thermocouple. In addition, the radiometer has been coupled with a webcam so that traditional methods of tracking flames with frame-by-frame image analysis can also be integrated into the same device, with the ultimate goal of being able to automate the study of flames via the use of Arduinos and MATLAB.

## **BH ENGINEERING**

MEMBERS: Brandon Haschke ADVISORS: Dr. C. Alex Simpkins SPONSORS: An Hong, Phil Davis - Vinatech Engineering, Inc.



#### **CNC ROUTER**

A 3 axis computer controlled cutting and engraving machine for various materials including wood, plastics, aluminum and steel.

## **CAPTURE THE VIBE**

MEMBERS: Lucas Zacharias, Derek Brown ADVISORS: Dr. C. Alex Simpkins SPONSORS: Drs. Annellen and C. Alex Simpkins, Sr.



#### **MOCAP: CAPTURE THE VIBE**

The goal of the motion capture (MOCAP) design project is to innovate upon Dr. Simpkins' motion capture device. We added new components, minimized the size of current components, and compacted it into a smaller device. The previous design consisted of a Bluetooth module, microcontroller and support circuit, accelerometer, and power supply. We improved upon this design by adding a camera, and microphone, into the device. We are working with two doctors of psychology to help track and log data for the study of "unconscious movement". Using an inertial measurement unit (IMU) we will be able to track the position/acceleration of a person's body part (wherever the unit is attached), while a microphone and camera will be able to interpret data from the world around it. A wireless transmitting device will track and record the data in real time. We applied this data to an infinity mirror where we were able to change the orientation of the inner LEDs using the microphone and IMU.

#### LAUNCH AND RECOVERY SYSTEMS DESIGN FOR AUTONOMOUS NAVAL VEHICLES

MEMBERS: Benjamin Cadua, Emily Escalante, Oscar Yee Jaime, Jeremiah Jeffries, Christian Kambourov ADVISORS: Vladimir Djapic - SSC Pacific, James Walton - SSC Pacific SPONSORS: SPAWAR Systems Center Pacific



#### LAUNCH AND RECOVERY SYSTEMS DESIGN FOR AUTONOMOUS NAVAL VEHICLES

The purpose of this project is to develop, design, and manufacture a launch and recovery system for both an Unmanned Aerial Vehicle (UAV) and Unmanned Underwater Vehicle (UUV). These systems will be specifically developed to support a Wave Adaptive Modular – Vessel (WAM-V), an Unmanned Surface Vehicle (USV).

## LOW COST DEMINER

MEMBERS: Tim Warcup, Connor Higgins, Delong Lim, Marko Vatavuk, Walid Amachraa ADVISORS: Dr. C. Alex Simpkins



#### LOW COST DEMINER

Low cost automated landmine removal vehicle for usage in underdeveloped countries or places with a high landmine density. Designed to be easily repaired and maintained.

## **MINI BAJA GEAR BOX**

MEMBERS: Luis A. Martinez, Samantha Moore, Hani Chalingo ADVISORS: Dr. C. Alex Simpkins SPONSORS: Self-sponsored



#### MINI BAJA GEAR BOX

To design and build a gearbox that can be used as a replacement for a DANA H-12 (13.12:1) gearbox. The DANA H-12 when combined with a CVT-Tech CVT is most commonly used when teams have a standard and basic driveline and a lower team budget to compete in these SAE events. This is where our design comes in, when teams want to step up and be more competitive they go to a higher performance CVT known as the GAGED CVT, that requires the use of custom made gearing. Our new gearbox design (6.63:1) allows the use of a Gaged CVT to its fullest potential, to become the winning team that can compete with the nation's top schools and engineering programs.

## S.T.A.R.

MEMBERS: Ryan Austin, Bernie Garcia, Francisco Garcia, Diego Gonzalez, Emeterio Hernandez, Darryl Miller

ADVISORS: Dr. C. Alex Simpkins

SPONSORS: Dr. C. Alex Simpkins, RDPRobotics



#### SOLAR TRACKING AUTONOMOUS ROVER

An automated rover with a micro-controller and array of sensors. It is designed to increase efficiency of solar panels and autonomously locate optimal location for solar collection. It will eventually be synchronized with Tilting Solar Panel group.

## **SD THRUSTER**

MEMBERS: Phong Huynh, Blake Ramuno, Caesar Amparo, John Schmidt, Randy Marles, Mayo Olagbemi ADVISORS: Mike McRory, Knuckledragger Design SPONSORS: Mike McRory, Knuckledragger Design



#### SD THRUSTER

One of the most interesting and innovative extracurricular organizations on campus is the SDSU Mechatronics Club. A competition is held annually where the Mechatronics team competes against other teams from other universities to design and build an autonomous submarine that runs an obstacle course. The team's design includes multiple thrusters in order to generate the movement required. Although the thrusters are performing their function, there is room for improvement upon their design and performance outputs. Thus, the Thruster Project was developed to explore the field of underwater propulsion. The main goal of this project is to characterize the existing Seabotix BTD 150 Thruster the current SDSU Mechatronics team is using for their Robosub through our own analysis and simulation. Then, we will use analysis and research to design a cheaper, more efficient thruster by modifying propeller design and shroud geometry.

## **SMART BOARD**

MEMBERS: David Cobb, Robert Hammett, Kristi Winter, Anthony Katkov ADVISORS: Dr. Kee Moon SPONSORS: Dr. Kee Moon and the National Science Foundation



#### SMART BOARD

A mobility board, designed to assist people who are disabled and injured. The Smart Board is easily controlled through the use of wireless motion sensors. These sensors pick up movement generated directly by the user, and sends it via Bluetooth to an Arduino Microcontroller. This allows the user to intuitively operate this vehicle by simply moving their body.

## SMARTBOARD POWERTRAIN

MEMBERS: Steven Dally, Wesley Davis, Jacob Goldsworthy, Nathan Reed

ADVISORS: Dr. Kee Moon SPONSORS: Dr. Kee Moon



#### SMARTBOARD

The Smartboard is designed with the purpose of allowing those with limited mobility to move about both indoor and outdoor terrain in the most intuitive way possible. Encompassing the familiar standing configuration of a traditional motorized skateboard, the Smartboard bolsters a novel powertrain design that optimizes maneuverability and stability. By utilizing a dual-motor, fixed-axle arrangement in the front along with a ball-in-socket roller in the rear, the design optimizes turning radius and overall maneuverability while still featuring a familiar and stable standing orientation. The combination produces an unrivaled operating experience embracing both a wonderful ergonomic feel and precise control. In order to make the overall user experience as natural as possible, a novel control system was implemented that reads the user's body movements and harnesses them as the Smartboard control inputs. The ability of the Smartboard to interpret the user's natural body movements breaks down the barrier between ordinary user and machine interaction, and introduces a device that is an extension of one's self. It makes getting where you want to go as intuitive as merely thinking about it. The end result is an overall experience more natural than any previous transportation device. The Smartboard allows users with limited mobility to break free of their limitations, and restores the mobility they have lost. It is our belief that an assistive device does not need to be a hindrance, but rather an extension of oneself to restore an abled body. With this idea, we proudly present the concept of the Smartboard.

## SYNAPSE RENEW

MEMBERS: David Connell, Ashley del Rosario, Brandon Haschke, Kathleen Lopez ADVISORS: Dr. C. Alex Simpkins

SPONSORS: Drs. Annellen and C. Alex Simpkins Sr., Dr. C. Alex Simpkins, RDPRobotics



#### REHABILITATIVE ROBOTIC TRAINING ARM

The primary goal of the project is to increase the neuroplasticity of stroke, spinal cord injury, and other trauma related patients. Through smooth, intensive, repetitive, and variable motor stimulation, the training arm will potentially enhance patients' ability to form new neural pathways and enhance their motor function. In addition, the training arm may also be utilized by athletes in order to sharpen skilled movement of the upper limbs. A cable driven delta robot design allows for smooth back driveable movement and is easily collapsible in order to facilitate convenient transportation to various locations enabling accessibility to patients and athletes.

## **TEAM NOMADS**

MEMBERS: Chris Garza, Michael Opazo, RyanScurlock, Danny Bloom, Kyle Greenleaf, Anton Medrano ADVISORS: Dr. C. Alex Simpkins

SPONSORS: Dr. C. Alex Simpkins, RDPRobotics



#### SOLAR TRACKER

Our project consists of the research, development, and prototyping of a product that efficiently converts solar energy to useable energy which is stored within a small battery bank. This product actively tracks the sun to maximize energy production while also minimizing its own energy usage. Future applications for this project consist of a moveable wheel base and modular integration for increased efficiency. Typical design aspects for this project include solar cell production, movement analysis, and circuit design.

## THERMOACOUSTIC REFRIGERATION SYSTEM

MEMBERS: Jeffrey Barr, Sebastian Madrigal

ADVISORS: Dr. C. Alex Simpkins, Stuart Thomas

SPONSORS: Stuart Thomas (Thomas Marine Inc.), Vince Rey (Bruel & Kjaer), Steve Lerwill (Pacific Refrigeration Inc.)



#### THERMOACOUSTIC REFRIGERATION SYSTEM

Solving the issue of implementing a sensor and data acquisition system that will provide numerous test points for temperature, pressure, and sound within a Thermoacoustic Refrigeration (TAR) system. These points will reside both inside the TAR system and externally within the heat exchanger networks. We will be working in conjunction with a support team in charge of a complete redesign of the current TAR system, in which, upon completion, will be able to test their system with our data acquisition sensor network.

## **UPPER-LIMB REHABILITATION VIRTUAL REALITY MODULE**

MEMBERS: Daniel Anderson, Christoph Barbod, Emily Lane, Kyle Seaman, Taylor Wagner ADVISORS: Harsimran Baweja, Ph.D., PT, Asst. Professor, Doctor of Physical Therapy Program, SDSU SPONSORS: Harsimran Baweja, Ph.D., PT, Asst. Professor, Doctor of Physical Therapy Program, SDSU



## UPPER-LIMB REHABILITATION VIRTUAL REALITY MODULE

Our team is designing an Upper-limb Rehabilitation Virtual Reality Module in order to assist those with upper-limb disabilities. The module consists of a tabletop surface as the bottom layer, a mirror as the middle layer and a television as the top layer. The bottom layer will provide a frictionless surface on which the user can perform various tasks without having to overcome the force of gravity. By coupling this technology with virtual reality achieved through the mirror and television layers, we are able to combine fun with physical therapy. Using various games that the user can play, the physical therapist will obtain valuable data on the person's movement.