

CELEBRATE THE SPIRIT OF  
INNOVATION...

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SPRING 2009  
SENIOR DESIGN  
COMPETITION

*The Howard R. Hughes  
College of Engineering*

FRIDAY,  
MAY 1, 2009

**UNLV**  
UNIVERSITY OF NEVADA LAS VEGAS



## Senior Design Experience

Part of every UNLV engineering student's academic experience, the senior design project stimulates engineering innovation and entrepreneurship. Each student in their senior year chooses, plans, designs, and prototypes a product in this required element of the curriculum. A capstone to the student's educational career, the senior design project encourages the student to use everything learned in the engineering program to create a practical, real world solution to an engineering challenge.

The senior design competition helps to focus the senior students in increasing the quality and potential for commercial application for their design projects. Judges from local industry evaluate the projects on innovation, commercial potential and presentation quality. One overall winner two winners from each discipline and one multi-disciplinary winner, two winners from each discipline, and one multi disciplinary winner (when applicable) are chosen and receive cash awards and commemorative plaques and medallions.

The competition has generated significant interest from the local community, and has provided additional motivation for students to be innovative and to produce quality projects.

## History

In 1999, the Entrepreneurship Club (E-Club) of the College of Engineering began sponsoring the Senior Design presentation event. The E-Club has been actively pursuing the goal of integrating entrepreneurship with engineering curriculum through seminars and facilitating senior design projects. In 2001, the E-Club conducted its first senior design competition. This opened the senior design event to Civil and Environmental, Electrical and Computer, and Mechanical Engineering students. The E-Club itself, the senior design projects and the competition all encourage students to become entrepreneurs upon graduation and contribute to the College's role in the economic diversification of the Southern Nevada area.

## The Awards

Beginning in 2002, College of Engineering supporters Harriet and Fred Cox have generously provided for the Harriet and Fred Cox Engineering Design Award to be given to the top outstanding projects in the senior design competition. Ongoing support for the awards has been established by their endowment gift to the College. The founder of four corporations — Emulex Corporation, Manufacturers Capital, California Data Processors, and Microdata Corporation — Fred Cox knows the value of entrepreneurship very well, and he and his wife Harriet are delighted to support the College of Engineering and our students in this significant venture. A special dinner in the spring celebrates the students' achievements and provides their families faculty and the greater Las Vegas community an provides their families, faculty, and the greater Las Vegas community an opportunity to share in the excitement of the students' work.

## **Senior Design Instructors**

***Dr. Paolo Ginobbi***

Department of Electrical & Computer Engineering

***Dr. Brian Landsberger***

Department of Mechanical Engineering

***Dr. Barbara Luke***

Department of Civil & Environmental Engineering

***Dr. Samaan Ladkany***

Department of Civil & Environmental Engineering

***Dr. John Wang***

Department of Mechanical Engineering

### **E-Club Faculty Members:**

***Dr. Laxmi Gewali***

***Dr. Henry Selvaraj***

***Dr. Rama Venkat***

***Dr. John Wang***

## **Judges**

**A Special Thank you to our  
Senior Design Industry Judges:**

***George Mayfield***

Bally Technologies

***Jonna Sansom, P.E.***

City of Henderson, Public Works

***Charles W. Scott, P.E.***

Las Vegas Valley Water District

# Presentation

Presentation Slot	Presentation Time	Senior Design Project Topic
Slot 1	9:00 - 9:30 a.m.	Elegant Bath Plumbing
Slot 2	9:15 - 9:45 a.m.	Electric Car Conversion
Slot 3	9:30 - 10:00 a.m.	Handicap Freedom Project
Slot 4	9:45 - 10:15 a.m.	Sustainable & Affordable Housing
Slot 5	10:00 - 10:30 a.m.	Biometric Password Keeping
Slot 6	10:15 - 10:45 a.m.	Wind River Canyon Sustainable Design
Slot 7	10:30 - 11:00 a.m.	Enhancing Transportation Experience
Slot 8	10:45 - 11:15 a.m.	What's in My Refrigerator
Slot 9	11:00 - 11:30 a.m.	Automated Velocity Regulating
Slot 10	11:15 - 11:45 a.m.	Lots of Pepper Now
Slot 11	11:30 a.m. - Noon	Optimum Draft Ceiling Fan
Lunch	Noon - 12:30 p.m.	LUNCH
Slot 12	12:30 - 1:00 p.m.	Home Power Meter
Slot 13	1:15 - 1:45 p.m.	Deep Space Laser Communication
Slot 14	1:30 - 2:00 p.m.	Multipurpose Dart Detection System
Slot 15	1:45 - 2:15 p.m.	A Geo-Thermal Heated Runway
Slot 16	2:00 - 2:30 p.m.	Concrete Canoe
Slot 17	2:15 - 2:45 p.m.	Supersonic Water Table
Slot 18	2:30 - 3:00 p.m.	Open
Slot 19	2:45 - 3:15 p.m.	Best Baja Buggy
Slot 20	3:00 - 3:30 p.m.	Hear My Volt
Slot 21	3:15 - 3:45 p.m.	Laughlin Sustainable Community
Slot 23	3:45 - 4:15 p.m.	Prestige Structural Design Workshop Structural Research Laboratory

# n Schedule

Title	Department
	Mechanical Engineering
	Mechanical & Electrical & Computer Engineering/ Interdisciplinary Project
ct	Mechanical Engineering
g in Iraq	Civil & Environmental Engineering
er	Electrical & Computer Engineering
velopment	Civil & Environmental & Mechanical Engineering/ Interdisciplinary Project
ce at UNLV	Civil & Environmental Engineering
r	Mechanical Engineering
System	Electrical & Computer Engineering
	Mechanical Engineering
n	Mechanical Engineering
	LUNCH
	Mechanical & Electrical & Computer Engineering/ Interdisciplinary Project
ion Link	Electrical & Computer Engineering
ystem	Electrical & Computer Engineering
Airfield	Civil & Environmental Engineering
	Civil & Environmental Engineering
	Mechanical Engineering
	Mechanical Engineering
	Mechanical Engineering
unity	Civil & Environmental Engineering
Id-Wide y Design	Civil & Environmental Engineering

**Senior Design Project Abstracts**  
**Cox Pavilion, Thomas & Mack Center**  
**May 1, 2009**

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**Time: 9:00 – 9:30 a.m.**  
**Elegant Bath Plumbing**  
**Department of:** Mechanical Engineering  
**Project Participants:** Jordan Mayorga and Suzie Minetree  
**Instructor:** Dr. Brian Landsberger  
**Faculty Adviser:** Dr. Darrell Pepper  
**Abstract**

There is probably no one among us who, while bathing, has not banged their head, back or shoulder into the spout of a bathtub. In particular, for small children who love to maneuver about the bathtub, the protruding spout can pose a safety hazard.

Our product, the Elegant Bath Fountain, targets high-end homeowners with small children, with a novel and elegant improvement in spout design that eliminates the chances of spout related injuries.

The Elegant Bath Fountain is the bath water delivery fixture you wish you had. This product provides maneuverability and safety in the bathtub by eliminating the protrusion of the bath spout into the bather’s space.

We accomplished this by creating a bath spout that is nearly flush with the wall. Multiple pipe and spout designs were evaluated to determine the best final design. This design is the overall optimum for the bathers’ safety, freedom of movement, tub fill, reduced splash and aesthetically pleasing water fill experience. The shower/tub selector valve located on the spout was placed up the wall between the hot and cold knobs, keeping the bathers space free from obstructions. Bathers should find a new and delightful bathing experience with the Elegant Bath Fountain.

**Notes:**

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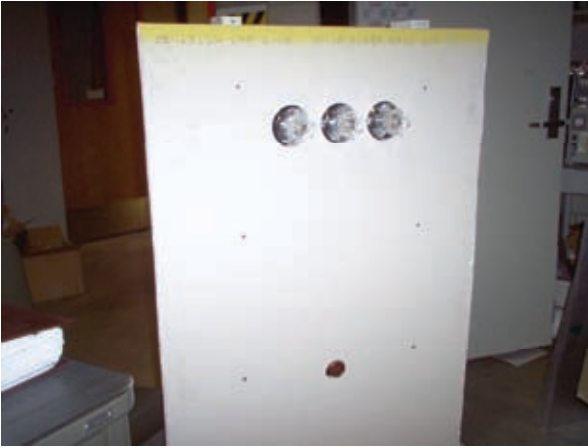
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(upper) Elegant Bath Fountain front view, (lower) View from rear showing plumbing of one test case.

**Senior Design Project Abstracts**  
**Cox Pavilion, Thomas & Mack Center**  
**May 1, 2009**

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**Time:** 9:15 – 9:45 a.m.

**Title:** Electric Car Conversion

**Department of:** Mechanical Engineering and Electrical and Computer Engineering

**Project Participants:** Brigham Joffs, Peter Faught,  
John Wardle, Don Twyman, and Makram Abd El Qader

**Instructor:** Dr. Brian Landsberger (ME) and Dr. Paolo Ginobbi (ECE)

**Faculty Adviser:** Dr. Yingtao Jiang, Dr. Jian Ma, and Dr. Venkatesan Muthukumar.

**Abstract**

Driven by high gasoline prices, concerns about pollution and the push toward green power, the interest in conversion to electric roadway vehicles has progressed from enthusiasts to the forefront of the general population. However, new all electric vehicles come with a very high price that limits their entry into the mass market. Alternately, many existing cars are good candidates for electric conversion at only a small fraction of the cost of the new electric car. Unfortunately, no standard conversion kit exists that is adaptable to multiple vehicles and can be purchased by drivers not inclined to devote long hours to the installation. This project has developed a conversion kit for those drivers.

The team designed an electric conversion kit for existing vehicles and used a 1980 Nissan 280Z as the demonstration vehicle. The car utilizes standard deep cycle batteries in series to run a variable speed electric motor. The conversion was tested and optimized for response; acceleration, range, load capacity and effect on ride comfort. A power monitoring systems was developed that creates a user-friendly instrument panel display.

This electric car conversion kit is designed to reach many car owners seeking a cleaner and cheaper transition into an electric car.

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**Senior Design Project Abstracts**  
**Cox Pavilion, Thomas & Mack Center**  
**May 1, 2009**

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**Time:** 9:30 – 10:00 a.m.  
**Handicap Freedom Project**  
**Department of:** Mechanical Engineering  
**Project Participants:** Ronn Fojas, James Spotts,  
Paul Texeira, and Victor Perez-Rubio  
**Instruction:** Dr. Brian Landsberger  
**Faculty Adviser:** Dr. Yi-Tung Chen

**Abstract**

For millions of Americans manual wheelchairs are a necessity for freedom of movement and access to necessities inside and outside the home. Even with motorized chairs and scooters available, the manual wheelchair continues to perform an essential function due to its cost, weight, size, transportability and reliability. Unfortunately, these wheelchairs have benefited only from small incremental improvement over the decades.

By comparison, bicycles, while retaining the advantages of a manual vehicle, have benefited from multiple innovations. Wheelchair users were canvassed to determine the most needed improvements. As a result, this project has applied drive-train technology designed for bicycles to improve the mobility of a wheelchair bound person.

Our product is a variable speed wheelchair. The variable-speed wheelchair design utilizes a planetary gear transmission internal to the wheel hub that the rider uses to selectively lower the force required to move the chair. The standard metal handgrip ring on the outside of the wheelchair wheels is no longer directly connected to the wheel but to the input of the transmission while the wheel is connected to the output. Gear shifting is accomplished with conveniently located click shifters. Wheelchair users can now adapt their drive to the varying conditions they face.

**Notes:**

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(upper) Standard wheelchair,  
(lower) Wheel hub with internal  
gearing.

**Senior Design Project Abstracts**  
**Cox Pavilion, Thomas & Mack Center**  
**May 1, 2009**

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**Time:** 9:45 – 10:15 a.m.  
**Sustainable and Affordable Housing Project in Northern Iraq**  
**Department of:** Civil and Environmental Engineering  
**Project Participants:** Josh Armstrong, Dianna Feica,  
Arlene Gloriani, and Eduardo Gonzalez  
**Instructor & Faculty Adviser:** Dr. Barbara Luke  
**Community Mentor:** Thor Armstrong

**Abstract**

The entire region of Northern Iraq is facing a serious housing shortage. This non-war-torn area is experiencing tremendous growth both in population and infrastructure since the fall of the Saddam Hussein regime. The non-profit group, “Shelter for Life,” has been involved in helping the people of Kurdistan to rebuild after many attempts by the previous administration to displace them. Now that the community is expanding, the need for innovative and sustainable solutions to the housing shortage is required. The Kurdistan Regional Government is giving land away so as to encourage growth in the region.

The idea is to create a community that does not rely entirely on public provision of electricity, wastewater treatment and drinking water supply, because of the unreliable nature of these services.

The houses within the community will be built using local materials and labor and will be designed to meet the needs of the population. Several design alternatives have been considered in the abovementioned areas.

Final selections were made on the basis of value, safety and feasibility. In addition, a general community layout and a computer generated 3D model were produced. This community will be a model for other emerging regions that require affordable and sustainable housing solutions.

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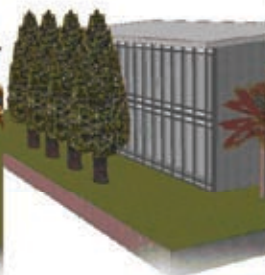
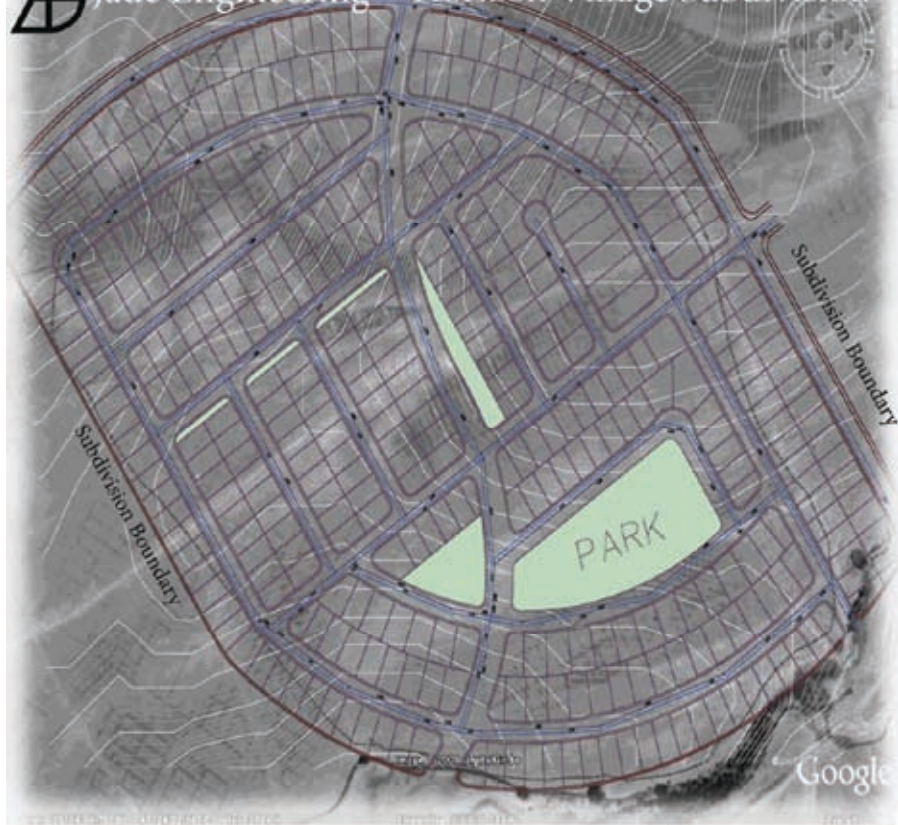
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## Jade Engineering - Horizon Village Subdivision



**Senior Design Project Abstracts**  
**Cox Pavilion, Thomas & Mack Center**  
**May 1, 2009**

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**Time:** 10:00 – 10:30 a.m.

**Biometric Password Keeper**

**Department of:** Electrical & Computer Engineering

**Project Participants:** James Aden, Christopher McElhone, and Alison Mina

**Instructor:** Dr. Paolo Ginobbi

**Faculty Adviser:** Dr. Emma Regentova

**Abstract:**

Can't remember your pin numbers and passwords but wouldn't dare store them on your computer for fear of spyware and hackers?  
Want to take your passwords with you everywhere you go?

The Biometric Password Storage Device is a stand-alone device that reads your fingerprint in order to store and display any personal information that you can't remember, but don't want to write down.

This device has an LCD screen to display your information, buttons for navigation, a fingerprint scanner for identity verification, and a USB port to interface with our custom PC software. The device will run on a battery so that you can access your personal data anywhere – at work, in your car, or even at the ATM!

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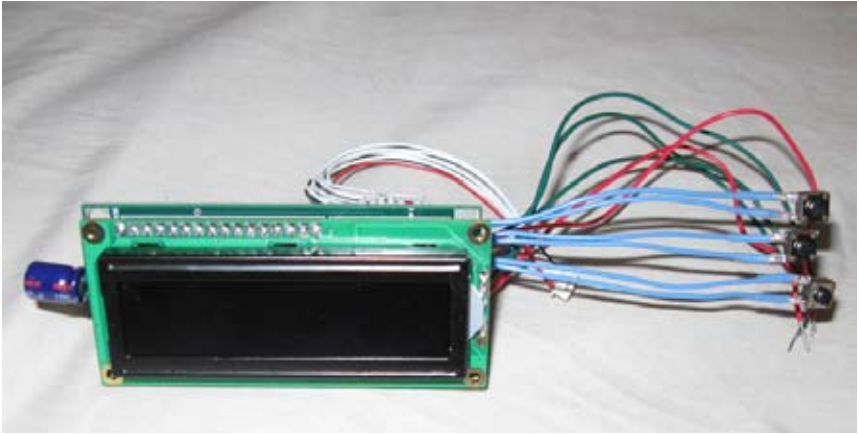
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**Senior Design Project Abstracts**  
**Cox Pavilion, Thomas & Mack Center**  
**May 1, 2009**

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**Time: 10:15 – 10:45 a.m.**

**Windriver Canyon Sustainable Development**

**Department of:** Civil & Environmental Engineering and Mechanical Engineering

**Project Participants:** Andrew Karasa, Pavel Kontchakov, Ernie Mejia, and Tony Tambaoan

**Instructor:** Dr. Barbara Luke (Civil) and Dr. Brian Landsberger (ME)

**Faculty Advisers:** Dr. Thomas Piechota and Dr. Robert Boehm

**Community Mentor:** Mr. Jeff Jensen, P.E.

**Abstract**

The team designed a 37 acre sustainable residential subdivision in Salida, Colorado for D'Signer Inc. The development consists of 99 condominium units. It is located on an alluvial fan in the foothills of Poncha Mountain. Responding to the State of Colorado's recent initiative for use of energy from renewable resources, the project integrated sustainable technologies including geothermal radiant heating, wind turbines, and solar panels.

First, an assessment phase was completed to evaluate protective facilities needed to convey storm and alluvial flow away from the development. The second phase included final layout of buildings, roadways, and grading coupled with incorporation of the protective measures identified in the assessment phase.

The property sits on a geothermal hotspot which also has 310 average sunshine days and ample constant wind velocity, making the site ripe for harvesting renewable energy. An existing geothermal tap 1/3 mile from the property was utilized for in-floor radiant heating and domestic water heating. Solar roof panels and wind turbines were analyzed and sized, and finally the best alternatives were integrated for generating supplemental electricity.

This project promotes green development concepts and sustainability in real estate. Once constructed, the development will help the regional energy producers conserve fossil fuels while helping the new residents save money on heating and electricity.

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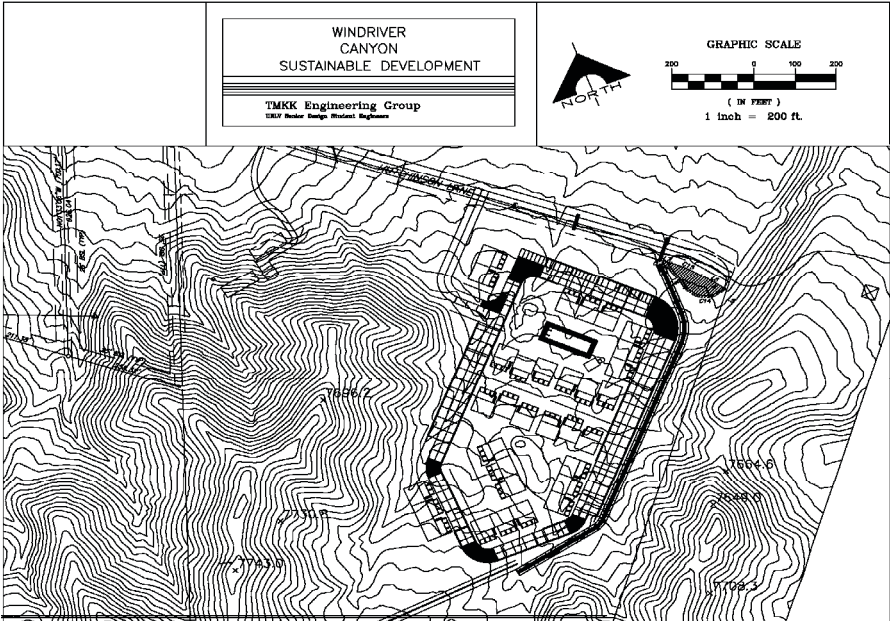
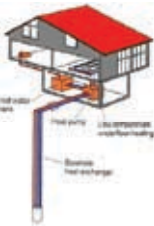
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**Senior Design Project Abstracts**  
**Cox Pavilion, Thomas & Mack Center**  
**May 1, 2009**

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**Time:** 10:30 – 11:00 a.m.

**Enhancing Transportation Experience at UNLV**

**Department of:** Civil & Environmental Engineering

**Project Participants:** Johnny Alhwayek, Oscar Quiroz, Chanon Ruangjumrusvet,  
and Noe Santos

**Instructor:** Dr. Barbara Luke

**Faculty Adviser:** Dr. Hualiang “Harry” Teng

**Community Adviser:** Mr. Kevin M. Futch, P.E., PTOE

**Abstract:**

From October 2005 to October 2008, there have been 3 fatalities and 144 traffic collisions causing 212 injuries along Maryland Parkway between Tropicana and Flamingo; an average of 1 collision per week! To better address the need for safety along Maryland Parkway and to better inform drivers about the road conditions, we have designed an intelligent transportation system and a pedestrian bridge for the university community.

The pedestrian bridge will allow for a safer crossing for community members along Maryland Parkway; furthermore, it will decrease the congestion caused by pedestrians using the existing crosswalks.

The intelligent transportation system will serve students and staff traveling to the university by displaying the best location to park their vehicle on variable message signs surrounding UNLV; furthermore, the system displays how many parking spots are available at the parking garage and the Thomas and Mack Center. The system has the capability to inform users about the traveling conditions by using the internet and wireless technology.

This project incorporates the use of renewable energy and sustainability in its designs by relying on solar energy, recycled materials, and wireless technology to decrease the project’s impact on the environment.

**Notes:**

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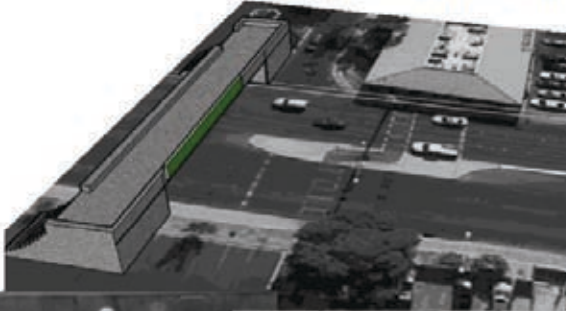
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A bridge across Maryland Parkway will improve traffic and pedestrian safety



An intelligent garage will be able to help drivers find parking quickly



Solar panels on the garage roof will provide shade to the vehicles and will offset electricity cost for the project

**Senior Design Project Abstracts**  
**Cox Pavilion, Thomas & Mack Center**  
**May 1, 2009**

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**Time: 10:45 – 11: 15 a.m.**

**What's In My Refrigerator**

**Department of:** Mechanical Engineering

**Project Participants:** Pamela Loftis, Brad Mortel,  
Dickson Ong, and Matthew Steinmetz

**Instructor:** Dr. Brian Landsberger

**Faculty Adviser:** Dr. Yi-Tung Chen

**Abstract**

Consumers spend a great deal of time in what appears to others as “gazing aimlessly into the depths of their fridge.” This habit not only wastes energy, but is also distracting to others and an inconvenience to the seeker. Customers that were interviewed expressed concerns in the loss of cold air, and over keeping their food properly chilled when the refrigerator door is constantly being opened.

Wouldn't it be useful if the contents of the refrigerator could be viewed without opening the door at all? Our project has achieved that with an on-demand transparent refrigerator door.

Our product is an on-demand transparent refrigerator door designed for high-end residential side-by-side refrigerators, demonstrated here with a small size refrigerator. Customer needs called for an opaque, attractive door appearance during normal operation and an instantaneous see through door when demanded.

Testing covering a new technology active design in which privacy glass is electrically switched between opaque and transparent, and a passive design where special glass tinting rendered the door transparency switchable based on interior lighting. Using a design of experiment covering variations in door glass tint, darkness and reflectivity the team determined the optimum passive and active door configuration.

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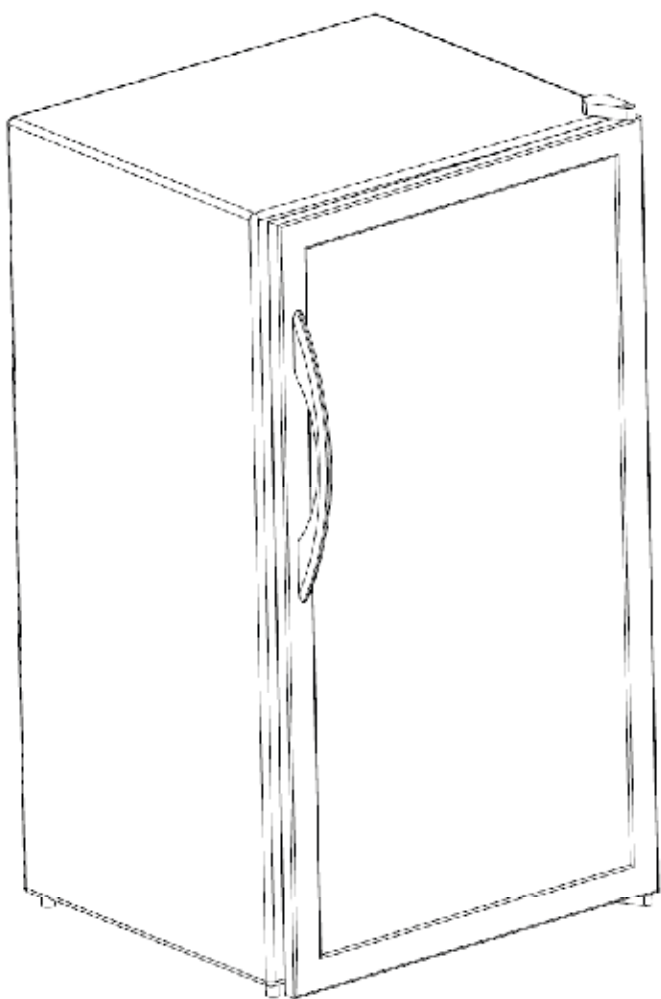
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Concept drawing of the transparency on-demand refrigerator.

**Time: 11:00 – 11:30 a.m.**

**Automated Velocity Regulating System**

**Department of:** Electrical & Computer Engineering

**Project Participants:** Miguel Castro

**Instructor:** Dr. Paolo Ginobbi

**Faculty Adviser:** Dr. Pushkin Kachroo

**Abstract**

According to the National Traffic Safety Administration (NTSA) 30% of all fatal vehicular crashes are related to speeding. Government officials have always implemented regulations, such as maximum speed limit signs and speed bumps, to help minimize this statistic.

Although speed bumps effectively help reduce speeds on small roads they cannot be practically used on highways, freeways or larger streets. Even though speed limit signs can be placed on any road they are very ineffective at enforcing the maximum allowable speed. Logically, a very effective solution encompasses the physical constraints imposed by the speed bumps and the iniquitousness of the speed signs.

By developing the Automated Velocity Regulating System (AVRS) I believe that I can eliminate the potential for any vehicle to exceed the maximum allowable speed of any road.

Instead of placing speed signs throughout the roads my system requires Bluetooth transmitters to send out signals of the maximum allowable speed to every vehicle within the range of the transmitter. AVRS also requires the cooperation of vehicle manufactures and government officials to implement Bluetooth receivers in every vehicle. These receivers will accept the maximum allowable speed and properly adjust the vehicle's accelerator to match this speed. Essentially, AVRS will eliminate speeding-related deaths.

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No photo or graph available

**Senior Design Project Abstracts**  
**Cox Pavilion, Thomas & Mack Center**  
**May 1, 2009**

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**Time:** 11:15 – 11:45 a.m.

**Lots of Pepper Now**

**Department of:** Mechanical Engineering

**Project Participants:** Sean Birnbaum, Elden Goddard, Christian Herrera, and Stoil Pamoukov

**Instructor:** Dr. Brian Landsberger

**Faculty Adviser:** Dr. Georg Mauer

**Abstract**

Professional chefs and gourmet cooks demands’ require small to large amounts of fresh ground pepper; and they would like it in a timely fashion. Current market automatic pepper grinders have one speed, which is too low an output to meet those demands. In some cases, cooks will modify existing pepper grinders with more powerful motors, such as a motor from a drill. Such modifications are used in order to grind pepper faster, but these devices are cumbersome, unreliable and lack good industrial design. This project offers an electric, high output, variable speed, pepper grinder that meets the demands of chefs and gourmet cooks.

Our product is a professional automatic pepper grinder. This grinder provides adjustable grind setting and significantly higher flow rates than current grinders while maintaining excellent grind consistency.

A pressure sensitive trigger provides variable grind rates. Power is provided by fully integrated, rechargeable batteries. Since this is designed for constant use, there is a very large pepper storage capacity with easy refilling.

A multi-parameter design of experiment was used to determine the motor size, voltage/power requirements, and grinder element selection for optimum operation under the various strenuous demands of the professional chef and gourmet cook.

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(upper) Photo of the functional prototype used in testing, (lower) Component view expansion of the new pepper grinder

**Time:** 11:30 a.m. – Noon

**Optimum Draft Ceiling Fan**

**Department of:** Mechanical Engineering

**Project Participants:** Mohamad Hachem, Jose L. Miranda Jr., and Kyle Schoen

**Instructor:** Dr. Brian J. Landsberger

**Faculty Adviser:** Dr. Liangcai Tan

**Abstract**

Ceiling fans are an essential part of the air circulation system in homes. They are used to increase occupant comfort by creating a pleasant draft in the room. Ideally, customers would like the fan to provide that pleasant draft throughout the room. Unfortunately, current ceiling fans provide a strong vertical draft directly beneath the fan and little draft several feet to the side, thus simultaneously creating zones of excessive draft and insufficient draft.

In contrast, our product is a new generation ceiling fan that provides noticeably improved air circulation throughout a room.

The team designed a strikingly different new generation ceiling fan blade shape that is able to provide a refreshing breeze to most of the room.

To achieve this breakthrough, the team used the principles of Design For Six Sigma to create and execute a design of experiment in which four critical ceiling fan blade parameters were varied.

A fan equipped with the new blades was tested in a full-scale automated room air systems laboratory where precise draft and sound level measurements revealed the entire draft pattern of each fan blade combination. Using statistical analysis of the results, the team was able to identify the optimum configuration.

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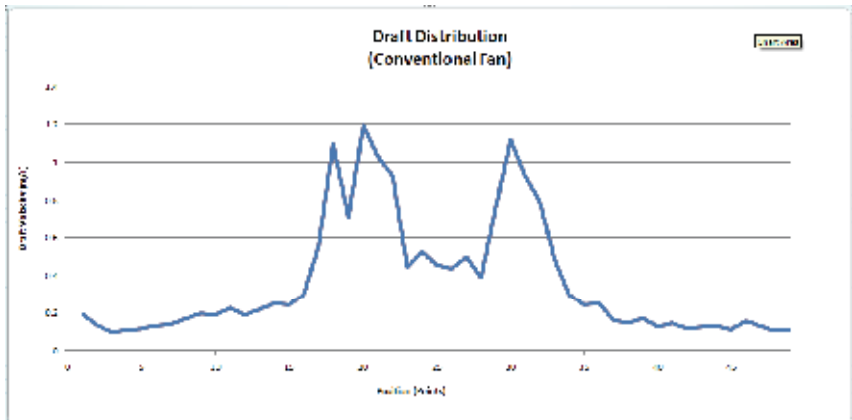
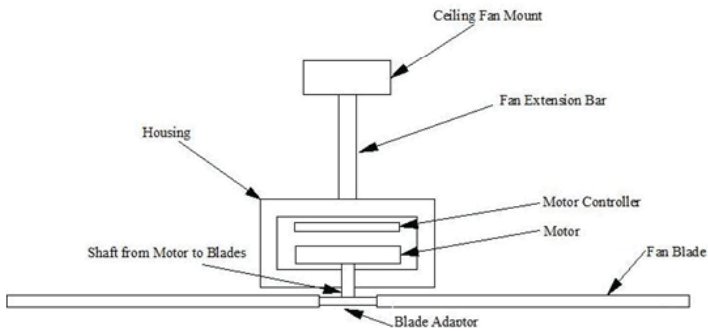
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## Product Architecture



(upper) Geometric layout of product architecture, (lower) Draft distribution in room with unmodified ceiling fan in the center.

**Senior Design Project Abstracts**  
**Cox Pavilion, Thomas & Mack Center**  
**May 1, 2009**

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**Time:** 12:30 – 1:00 p.m.  
**Title:** Home Power Meter  
**Departments of:** Mechanical Engineering/and  
Electrical & Computer Engineering  
**Project Participants:** Ken Hynes and Devin Taylor  
**Instructor:** Dr. Brian Landsberger (ME), Dr. Paolo Ginobbi (ECE)  
**Faculty Adviser:** Mr. Rick Hurt  
**Abstract:**

Expensive power bills and the challenge of moving toward a cleaner and more sustainable lifestyle have led home owners to seek energy efficient technologies and ways to combat ever increasing electricity costs.

Currently, homeowners have no real-time information regarding their home power usage and therefore are limited in their ability to effectively monitor energy consumption. The goal of this project is to provide homeowners with easily accessible, real-time information about their home power and energy consumption.

Our product is an in-home electric power usage monitoring system for residential housing. It provides the homeowner with the overall instantaneous power demand of the home, while simultaneously tracking the overall energy consumption for a user specified period of time.

Consequently, the homeowner receives not only information on the power usage of all electric devices at any time but also a running total cost of the power bill for the specified period of time. This information is provided to the homeowner in a small, user friendly, indoor unit with a graphical touch screen interface, which easily mounts to the wall of the homeowner's choice. The integration of our product will allow homeowners to take control of their energy habits and become more energy conscious.

**Notes:**

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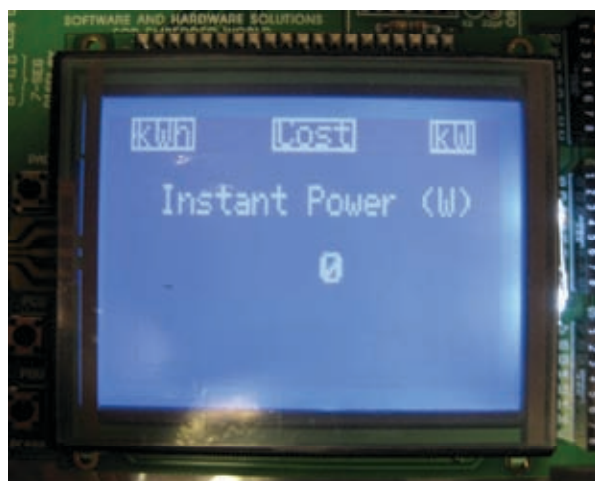
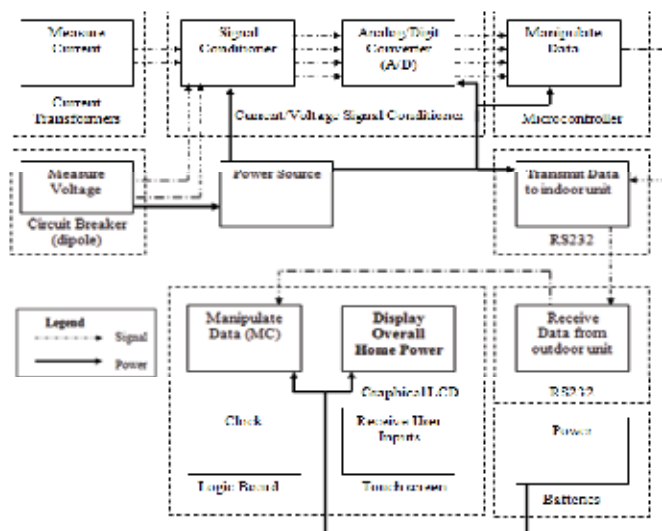
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(upper) Power meter architecture schematic, (lower) Picture of LCD display screen.

**Senior Design Project Abstracts**  
**Cox Pavilion, Thomas & Mack Center**  
**May 1, 2009**

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**Time:** 1:15 – 1:45 p.m.

**Deep Space Laser Communication Link**

**Department of:** Electrical & Computer Engineering

**Project Participants:**

Christopher L. Beeghly, Edward Bravo, and Alex Minor

**Instructor:** Dr. Paolo Ginobbi

**Faculty Adviser:** Dr. Shahrim Latifi

**Abstract:**

Present technology uses radio waves to communicate between Earth and Mars. Radio communication is approximately 10 times slower than visible or near visible communication. Information being transmitted over radio waves has the susceptibility of being stolen.

The development of a laser communication link would allow for secure point to point communication as well as faster transmission when used as an interplanetary device.

Our Laser Communication Link demonstrates that a laser can be used as a communication channel. This is demonstrated by having the user type information into HyperTerminal on the transmitting computer, and having the information displayed on the receiving computer. The user is also capable of retrieving information stored onto a microcontroller which is located at a distance.

Due to the advantages in speed and security, laser communication is a plausible technology for the near future.

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**Senior Design Project Abstracts**  
**Cox Pavilion, Thomas & Mack Center**  
**May 1, 2009**

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**Time: 1:30 – 2:00 p.m.**

**Multipurpose Dart Detection System**

**Department of:** Electrical & Computer Engineering

**Project Participants:**

Jeff Hurley, Michael Wong, and Cheng Yang

**Instructor:** Dr. Paolo Ginobbi

**Abstract:**

In the casino gaming industry there are many different types of technologies. The industry always needs new games to keep the public interested. Our design meets that challenge of interesting the public with a multipurpose dart detection system.

The system will feature a simple dart game containing the complexities of sensors that will detect the position of the dart when the dart strikes the board.

The dartboard will have a random jackpot not based on skill to add to the experience. This will require the usage of electronic design including PCB fabrication, a microcontroller, light emitting diodes (LED) & photo sensors pairs, as well as digital logic. The dart board will have the ability to communicate with other devices via USB 2.0. Once the dart strikes the board, the board will detect the dart's position and send a signal to an outside device/game/network to produce a random result.

This result will be associated with a gaming system that will allow the player to possibly receive some jackpot based on their performance. The prototype will involve a level of versatility as well as randomness to produce a marketable product for the gaming industry.

**Notes:**

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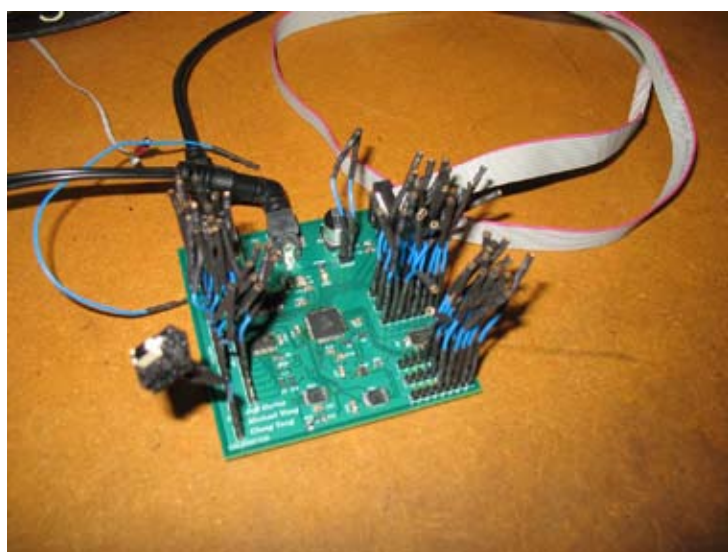
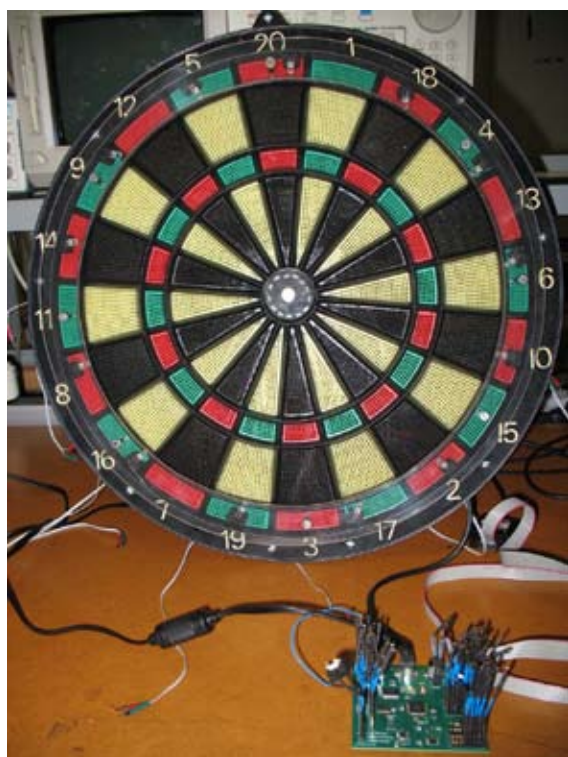
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**Senior Design Project Abstracts**  
**Cox Pavilion, Thomas & Mack Center**  
**May 1, 2009**

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**Time: 1:45 – 2:15 p.m.**

**A Geo-Thermal Heated Runway Airfield**

**Department of:** Civil & Environmental Engineering

**Project Participants:** Marc Cutler & Donn Williams

**Instructor:** Dr. Barbara Luke

**Faculty Adviser:** Dr. Moses Karakouzian

**Abstract:**

Every winter season many airports experience an accumulation of snowfall that must be cleared, insuring runways are free of snow and ice. Methods used to accomplish this are snowplowing and the application of chemicals. We propose a highly innovative solution to mitigate snow buildup on the Colorado Springs airport runway.

The runway pavement will be heated radiantly via heated fluid flowing through elastic pipelines embedded in the pavement. The purpose of the design is to increase heat surrounding a desired area to melt the snow upon its contact with the pavement. This will reduce runway closures and the time needed to clear runways of snow which cause delays and heavily effect airport travel times as well as possible energy and time savings.

**Notes:**

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**Senior Design Project Abstracts**  
**Cox Pavilion, Thomas & Mack Center**  
**May 1, 2009**

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**Time: 2:00 – 2:30 p.m.**

**Concrete Canoe**

**Department of:** Civil & Environmental Engineering

**Project Participants:** Tiffany Hearn, Nicole Melton, and  
Adam Pocock

**Instructor:** Dr. Barbara Luke

**Faculty Adviser:** Dr. Aly Said

**Community Mentor:** Mr. James Marrs, P.E.

**Abstract**

The main goal of our team was to plan, design, and construct concrete canoe in accordance with the National Concrete Canoe Competition Rules and Regulations.

Our canoe represented the UNLV College of Engineering as we competed against other teams in the PSWRC in Hawaii.

The purpose of our project was to create a stable lightweight mix design for our concrete, utilize a strong yet light-weight tensile reinforcement, and generate an aesthetically pleasing canoe with a minimal impact on the environment. Innovation, sustainability, and performance played a major factor in our materials and aesthetical choices. Our team had to implement the knowledge gained at UNLV in structural design, construction management, and materials to complete our goals and the project successfully.

Highlights of the project included utilizing 95% recycled material within our concrete mix design, including aggregate manufactured by the team using recycled glass from local bars. The concrete mix designed was lighter than water with a unit weight of only 50.98 lb/ft<sup>3</sup>. Stains for the aesthetics portion were soy based and completely environmentally friendly. The inside of the canoe was decorated with a glass mosaic inlay consisting of crushed recycled glass bottles.

**Notes:**

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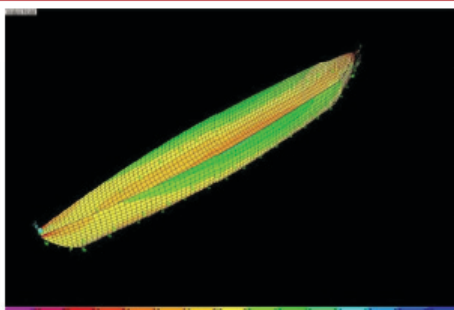


Figure 1: SAP 2000 Structural Analysis of Hull



Figure 2: Slump Testing of Concrete Batch



Figure 3: Production of Glass Aggregate



Figure 4: Styrofoam Mold Preparation



Figure 5: Finishing of the Canoe



Figure 6: Glass Mosaic



Figure 7: Finished Canoe



**Time:** 2:15 – 2:45 a.m.

**Supersonic Water Table**

**Department of:** Mechanical Engineering

**Project Participants:** David Glaser and Wade McElroy

**Instructor:** Dr. Brian Landsberger

**Faculty Adviser:** Dr. Darrell Pepper

**Abstract:**

Many universities offer fluid mechanics and gas dynamics courses yet have difficulty offering their students clear, readily available, real-time visualizations of supersonic flow shockwave behavior. Wind tunnels that can demonstrate supersonic flow are expensive to acquire and operate, require dedicated laboratory space and special instrumentation. Our product is a supersonic flow table that provides a quick, easy and mobile real-time representation that is visual, intuitive, and is specifically designed for in-class demonstrations of multiple different supersonic airfoil and flow phenomena.

Water flow tables operate on the theory of the hydraulic analogy, which states that, the surface wave wake behavior for shallow water flows is analogous to shock wave behavior in supersonic airflows. Supersonic shock wave water tables take advantage of this analogy and use shallow water flows of several feet per second to demonstrate shock wave phenomena up to hypersonic conditions.

Our system was custom designed to provide optimum performance and exceptional ease of use. The system test area can accommodate a large variety of flight objects over a large range of simulated mach numbers while maintaining quiet undisturbed steady-state flow. The system is entirely self contained, plugs in anywhere and provides easy water fill and drainage.

**Notes:**

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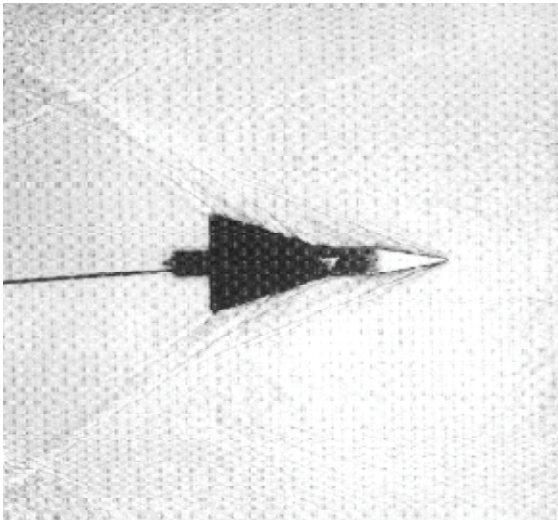
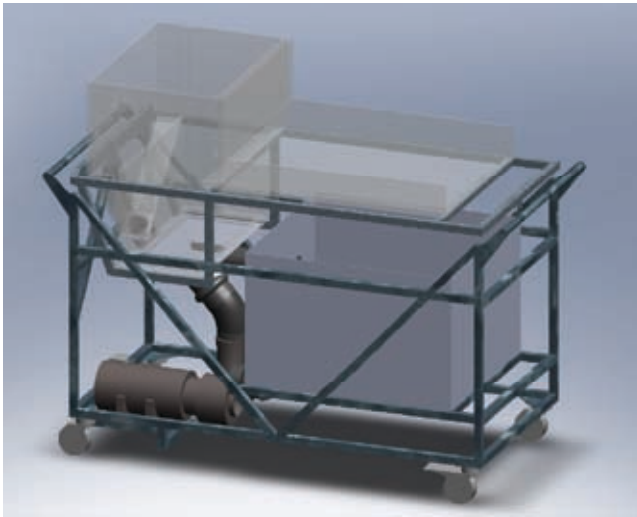
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(upper) Computer Rendering of the final Supersonic Water Table. (lower) Water table picture of object at Mach 4.10, picture taken from NASA Technical Memorandum 4631 May 1995.

**Senior Design Project Abstracts**  
**Cox Pavilion, Thomas & Mack Center**  
**May 1, 2009**

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**Time: 2:30 – 3:00 p.m.**

**OPEN**

**Department of:**

**Project Participants:**

**Instructor:**

**Abstract:**

**Notes:**

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**Senior Design Project Abstracts**  
**Cox Pavilion, Thomas & Mack Center**  
**May 1, 2009**

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**Time:** 2:45 – 3:15 p.m.

**Best Baja Buggy**

**Department of:** Mechanical Engineering

**Project Participants:** Michael Calabro, Vinicio Franco,  
Ron Lyster, Andy Martinez, and Jon Schweter

**Instructor:** Dr. Brian Landsberger

**Faculty Adviser:** Dr. Brendan O'Toole

**Abstract**

Off-roading is an increasingly popular recreation activity. Unfortunately, many off-road buggies and go-karts on the market lack many critical safety features. In addition, because the vehicles are general in design they have limited capabilities for many specific purposes. For example, go-karts are typically underpowered, and built with limited safety features while other buggies or side-by-sides are often built with the dual purpose of being recreational and utility vehicles, resulting in high centers of gravity, and limited safety features. This project has developed a buggy specifically for recreational riding with multiple performance and safety enhancements.

Our product is an off-highway vehicle, a 'Baja Buggy' with a full roll cage, 5-point safety harness, and optimized length of suspension travel capable of safe, exciting, and high-performance riding over very rough terrain. Careful analysis of the cage strength with simulated impacts led to a lightweight tube frame construction that provides excellent protection yet allows great visibility and easy ingress and egress. A dragster like cockpit provides comfort and intuitive vehicle control. Off-road testing under extreme conditions was used to optimize several stability parameters such as shock response and wheel alignment for responsive handling under all conditions.

**Notes:**

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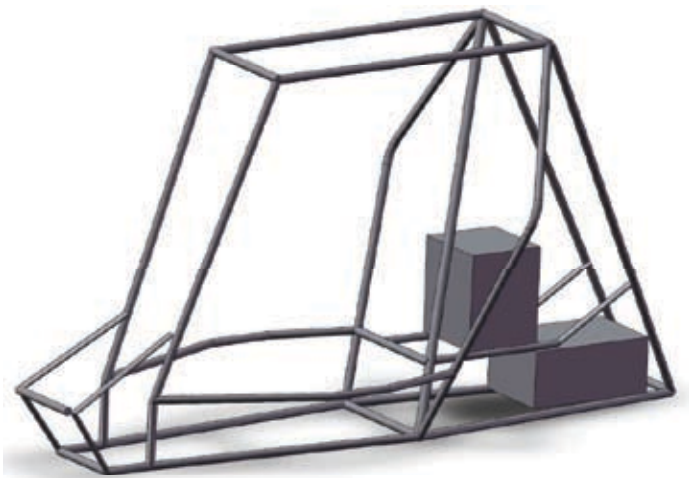
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(upper) Team logo, (lower)  
Computer model of buggy  
frame.

**Senior Design Project Abstracts**  
**Cox Pavilion, Thomas & Mack Center**  
**May 1, 2009**

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**Time: 3:00 – 3:30 p.m.**

**Hear My Volt**

**Department of:** Mechanical Engineering

**Project Participants:** Wendell Concina, Todd Peters, Zaccary Potts, and  
Marcella Sosa

**Instructor:** Dr. Brian Landsberger

**Faculty Adviser:** Dr. Mohammed Trabia

**Abstract**

The green lobby loves them and they have become Hollywood's latest status symbol: Electric-powered vehicles including hybrids. Along with their 'green' attributes, electric vehicles are quiet, which creates a new safety risk when pedestrians do not hear them coming.

A recent study found that a gasoline car could be heard 36ft away but a Hybrid was not heard until it was within 11ft. This project has developed a product to alert the at-risk pedestrians.

The team designed and built a prototype pedestrian alert system for any electric vehicle. Using functional requirements developed from customer interviews the team developed a system that alerts the pedestrians but does not create a nuisance to others.

The system uses an array of weatherproof speakers to project electronically recorded engine noise in the area ahead of the vehicle. A computer takes the speed of the vehicle as an input and then controls the loudness of the alert sound so that pedestrians are alerted sufficiently in advance of the vehicles arrival.

Tests were run to determine the best alert noise, the optimum volume level and degree of directionality of the projected sound. The prototype can be easily integrated into the control module of all electric cars.

**Notes:**

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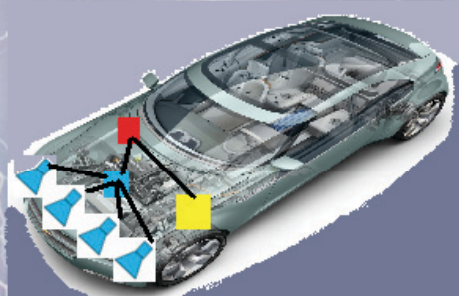
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# Hear My Volt



Project logo showing major component locations

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**Time:** 3:15 – 3:45 p.m.

**Laughlin Sustainable Community**

**Laughlin's Southlands: 9,000 Acre Sustainable Master Plan Community**

**Department of:** Civil & Environmental Engineering

**Project Participants:** Brooks Gebrechristos, Getachu Melaku, Alvin Morris IV, Jaime Reddic, and Michelle Thung

**Instructor:** Dr. Barbara Luke, P.E.

**Faculty Advisor:** Dr. Thomas Piechota, P.E.

**Community Mentor:** Mr. Matthew Meyer, P.E.,

### **Abstract**

The Town of Laughlin is the main source of employment for residents in its surrounding area. In the late 1980's, the town of Laughlin experienced a significant development boom, but due to a lack of privately held, developable land, the growth of the town has slowed since 2004.

To help continue growth of the town, 9,000 acres of land will be used to build much needed residential and commercial buildings. The land will be developed, while especially keeping green aspects in mind, by using the otherwise "unusable" land to implement renewable energy sources such as solar and wind energy, and by using building materials that are sustainable.

The Green Team has completed conceptual and feasibility studies of this proposed community. We have designed a conceptual master plan of the community and conducted drainage studies of the existing and proposed land.

If implemented, we believe our design will reward the town **environmentally** due to the sustainability factors that have been taken into account, **economically** by increasing the town's revenue through sales and property taxes, and **socially** by growing and diversifying the population of the town.

### **Notes:**

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## LAUGHLIN'S SOUTHLANDS



**Senior Design Project Abstracts**  
**Cox Pavilion, Thomas & Mack Center**  
**May 1, 2009**

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**Time:** 3:30 – 4:00 p.m.  
**Las Vegas Blvd Light-Rail Transportation System**  
**Department of:** Civil & Environmental Engineering  
**Project Participants:** Trevor Ross, Vikhas Sehdev,  
Bao Tran Tran, and Anton Vialtsin  
**Instructor:** Dr. Barbara Luke  
**Faculty Adviser:** Dr. Alexander Paz  
**Community Mentor:** Mr. David Swallow ‘94  
**Abstract:**

Several decades ago, Las Vegas Boulevard was called Arrowhead Highway, but today it is one of the busiest and traffic congested streets in the nation. Light rail became an evident solution to the traffic problem on the “Strip”.

CTS Team designed a light-rail system in which a busy individual is happy to get to work on time and hotel owners, who want a slow stream of traffic so their property frontage appears more attractive to tourists, can live in peace. Americans lose \$63 billion per year in productivity sitting in traffic, and if you are trying to get to work on the Las Vegas Boulevard, you will never make it to your destination on time.

The light rail is a more reliable system than the current bus system since it runs along the tracks independent of other vehicles and is able to transport more people at a time than buses. The speed of the rail can be altered to satisfy the wants of property owners; therefore, making a system that increases a steady reliable flow by increasing the capacity of people on Las Vegas Boulevard and not affecting the travel time.

**Notes:**

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Top Photo: by [David Vasquez](#), Middle: ghost depot.com,  
Bottom:  
[http://2.bp.blogspot.com/\\_o6IVQPKZooc/RmXGAm84JVII/AA/AAAAAAAOI/45OBz\\_uJwMQ/s400/traffic.jpg](http://2.bp.blogspot.com/_o6IVQPKZooc/RmXGAm84JVII/AA/AAAAAAAOI/45OBz_uJwMQ/s400/traffic.jpg)

**Senior Design Project Abstracts**  
**Cox Pavilion, Thomas & Mack Center**  
**May 1, 2009**

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**Time:** 3:45 – 4:15 p.m.  
**Prestige Structural Design Worldwide (PSDW)**  
**Structural Research Laboratory Design**  
**Department of:** Civil & Environmental Engineering  
**Project Participants:** James Bristow, E.I.,  
Christopher Strout, E.I., and Jason Tankersley, E.I.  
**Instructor:** Dr. Barbara Luke  
**Faculty Adviser:** Dr. Aly Said and Dr. Ying Tian  
**Community Mentors:** Nr. Robert Naples, P.E. & Mr. Carlos Banchik, P.E.

**Abstract:**

The Howard R. Hughes College of Engineering at the University of Nevada, Las Vegas (UNLV) currently lacks the capability of performing experimental research on full-scale structural members, such as reinforced concrete beams and columns.

With assistance from the UNLV Department of Planning and Construction, our team has designed and planned for the construction of a uniaxial loading system within an existing building on the UNLV campus. The design will provide professors and students the opportunity to test structural members under uniaxial loading while providing for future expansion to a system that allows for biaxial loading situations.

The major challenge of utilizing an existing structure is the insertion of the actual loading system as well as the testing specimen in the building. This will be accomplished by modifying the project site to include an overhead door system.

The actual testing system we are designing is a structural steel loading frame that will support reinforced concrete beams and columns under axial loading conditions until they reach failure. To ensure that this testing system will provide accurate measurements the load exercised on the specimen and steel frame must not dissipate into the surrounding structure.

This goal will be achieved by incorporating a reinforced concrete strong floor to isolate the testing system. The design also calls for a frame-to-floor anchoring system to ensure that all the loading is transferred to the strong floor.

**Notes:**

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Photo is of UNT High Bay Structures Lab  
**Photo of a similar steel reaction frame at UNT**



## **Award Winners**

Will be announced  
at the dinner May 1, 2009

### **Congratulations on your achievement.**

We look forward to seeing  
you tonight at the  
8th Annual Senior Design Dinner

**Cox Pavilion**  
**6:00 - 9:00 p.m.**

All projects should be available for viewing.  
At the request of Mr. and Mrs. Fred Cox, we  
also need projects for viewing on May 20, 2009  
UNLV Foundations Board of Trustee meeting.

