Celebrate the spirit of entrepreneurship...

Fall 2007
Senior Design Competition

The Howard R. Hughes College of Engineering

December 5, 2007

UNLV
UNIVERSITY OF NEVADA LAS VEGAS

Image courtesy of Phoenix International, Inc.

Fall 2007
Senior Design Competition

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 (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 opportunity to share in the excitement of the students' work.

Instructors for Senior Design Program:

Dr. Jaci Batista – Department of Civil and Environmental Engineering
Dr. Paolo Ginobbi – Department of Computer and Electrical Engineering
Dr. Brian Landsberger – Department of Mechanical Engineering
Dr. Edward Neumann – Department of Civil and Environmental Engineering
Dr. Walter Vodrazka – Department of Civil and Environmental Engineering

E-Club Faculty Members:
Dr. Laxmi Gewali
Dr. Henry Selvaraj
Dr. Rama Venkat
Dr. Zhiyong Wang

A Special Thanks to our Senior Design Industry Judges:

Ron Gross, P.E.
Special Programs Department
Remote Sensing Labs—Nellis AFB

Lee Kramer
Vice President of Engineering
Xtreme Manufacturing

David Peterson
Lochsa Engineering

9:00 - 9:30 a.m. Open

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9:15 – 9:45 a.m.

Title: Brine Evaporation Pond System

Department of Civil and Environmental Engineering
Project Participants: Kayli Barber, Ivana Barrajas, and Cassandra Watson
Instructor: Dr. Walter C. Vodrazka
Faculty Adviser: Dr. Jaci Batista
Community Mentor: Mr. Walter Johnson

The purpose of this project is to develop a Brine Evaporation Pond System (BEPS) that meets the needs of the first phase of construction for the proposed reverse osmosis/micro filtration (RO/MF) water treatment facility. This RO/MF water treatment facility will drastically improve water quality in Southern Nevada and the Colorado River. One of the largest benefits to this system is the reduction of high concentrations of TDS in the Colorado River.

The removal of large amounts of TDS during the RO/MF treatment process will help solve the growing problem of salts in the Colorado River. However, the salts (brine) removed during the RO/MF process need to be managed. The 25MGD RO/MF facility is projected to generate 0.55 MGD of brine. To remediate and handle the volume of brine produced, a BEPS must be built. The major goal of this design project is to provide a design of the BEPS in a report and detailed plan drawings.

Fifteen ponds are proposed in the design, and each pond has a proposed flow filling, evaporation, and cleaning schedule. This schedule is based on an initial brine concentration of 79,772 mg/L and a final brine concentration of 300,000 mg/L.

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9:30 - 10:00 a.m. Open

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9:45 – 10:15 a.m.

Title: New Generation User-Adaptable Radiation Detector (New-G.U.A.R.D.)

Department of Electrical and Computer Engineering
Project Participants: Rogelio Esparza and Alexander E. Harris
Instructor: Dr. Paolo Ginobbi
Faculty Adviser: Dr. Shahram Latifi
Community Mentor: Mr. Venka Palaniappan and Mr. Aaron Ponzio

Abstract

The purpose of this project is to provide an "all-in-one" solution for radiation data-logging. Presently, users such as the military have to carry multiple instruments to obtain accurate information, including a bulky radiation detector and separate GPS unit. The New-G.U.A.R.D. provides the user with not only radiation readings, but will also log the user's position and auto-correct misinterpreted data.

The New-G.U.A.R.D. device incorporates a GPS system, a digital compass, and tilt-monitoring device, and a built-in radiation detector. The unit stores data via SD memory card and also sends out the data via Bluetooth communication. The user is able to monitor the data in real-time via the built-in LCD screen. The unit can be used as a stand alone device and the saved data can be further analyzed and processed, as per the user's need.

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10:00 – 10:30 a.m.

Title: Parental Keyboard Alert System

Department of Electrical and Computer Engineering
Project Participants: Bianca Davis and Arrielle Mathis
Instructor: Dr. Paolo Ginobbi
Faculty Adviser: Dr. Emma Regentova

Abstract

Statistics show that approximately 90 percent of children and adolescents ages 5–17 use computers and approximately 59 percent use the Internet. Due to these statistics, it is becoming a major concern of parents to be able to monitor the internet usage of children. Though children mainly use the internet to play games, conduct research for school, and to chat with friends, there are millions of websites that are inappropriate for children to view. These websites can easily be accessed by typing in a few keywords.

The Parental Keyboard Alert System will provide a device for parents that will allow them to monitor their children's internet usage without being in the same room, or even the same house with the child.

The goal of this project is to design a keyboard alert system that will allow normal keyboard input, as if it were not connected. However, upon detecting a word or words that are part of predefined list, the device will send an email to the parent, informing them that these words have been input. It is also our goal to make the device as small as possible so that it may not be detected by the child.

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10:15 -10:45 a.m.

Title: Liquid Cooled Computer

Department of Mechanical Engineering
Project Participants: Jacob Ludwig, James Mulford, and Mike Roscoe
Instructor: Dr. Brian Landsberger
Faculty Adviser: Dr. Robert Boehm

Abstract

Computer graphic designers, 3-D gamers and other computer high performance users need every ounce of capability from their computers. Unfortunately, the performance and stability of the most powerful home computers is limited by the design's ability to dispel the heat that the computer processor chip produces. The vast majority of these computers on the market are air cooled.

The team has developed a liquid cooling system that will remove heat from the computer processor at a higher rate than an air-cooled system. The team used a finned copper block on the processor for both a heat sink and an efficient heat exchanger to the cooling liquid. Coolant is then pumped through the assembly to an external radiator that uses forced air to cool the liquid. The innovative copper block design maximizes heat removal at the processor and should provide an advantage over the current liquid cooled system on the market.

With this product users can over-clock the processor (utilize higher processor speeds) for increased performance while maintaining system stability. The product also provides the added benefits of quieter operation and smaller space requirements as compared to air-cooling solutions.

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10:30 – 11:00 a.m.

Title: Electronic Door Lock

Department of Electrical and Computer Engineering
Project Participants: Joann DeLellis, Nathan Lehman, and Dustin Pike
Instructor: Dr. Paolo Ginobbi
Faculty Adviser: Dr. Paolo Ginobbi

Abstract

A realtor asked us to find a way to call a property to lock or unlock the door for access to clients. The project will involve two parts:

- A smart locking mechanism: sensory adapted to transmit and receive signals from the user via telephone or touchpad commands.

- and smart telephone interface: a password protected device similar to an answering machine which will provide interaction between the caller and the lock. Voice signals prompt the user who responds via touch tone.

The communication link between the two is through use of Bluetooth technology's BlueSMiRF which will provide a secure and reliable connection up to 350 ft. between the two devices.

The Electronic Door Lock arises from a need for security. Anyone with the correct password will be able to call any property and check to see if their door is locked or unlocked. The user will then have the option to lock or unlock the door. This device isn't just for realtors; it can be used by anyone with the desire to have more control over access to a property.

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10:45 - 11:15 a.m.

Title: HDTV Pattern Generator

Department of Electrical and Computer Engineering
Project Participants: Kareem Matariyeh and David Sutanto
Instructor: Dr. Paolo Ginobbi
Faculty Adviser: Dr. Paolo Ginobbi

Abstract:

Our project is a HDTV pattern generator to help average consumers and expert TV technicians calibrate their HDTV's for optimum image quality and viewing experience. The design was implemented using a programmable logic controller, and a recently designed HD transmitter chip for displaying the video image, the entire device is controlled by a small microprocessor with a button/LCD interface.

One of the main problems this project tackles in a commercial sense is cost; most companies sell their pattern generators for obscene amounts of money and come with few if any features or capabilities.

This project is competitive with current designs in the market by allowing the device to be reprogrammed to include more features at a later time, the patterns are stored on a user customizable SD card allowing the pattern generator to use more seldom used test patterns and can allow the device to work as a normal picture viewer with a few firmware modifications.

The unit is designed in a modular fashion, allowing fabrication and failed unit costs to be lower than most current pattern generators when produced on a large scale.

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11:00 – 11:30 a.m.

Title: Cool Alternatives

Department of Mechanical Engineering
Project Participants: Christopher Helda, Justin Leany, and Denney Shinn
Instructor: Dr. Brian Landsberger
Faculty Adviser: Dr. Samir Moujaes
Community Mentor: Mr. Todd Jones, Siemens Building Technologies

Abstract

Air conditioning a home in the hot desert climate is expensive and as energy costs are expected to rise, the cost of air conditioning will also rise. Current less expensive alternatives such as evaporative cooling (swamp coolers) do not meet customer comfort expectations on hot days due to limited cooling capability, or on humid days due to cooling that result in uncomfortable indoor humidity.

The goal of this project is to develop an alternative cooling method for desert climate homes, which delivers customer expected air conditioning performance, while lowering both initial investment and operating costs.

The team designed a system of sequenced evaporative coolers that utilizes the low cost cooling available through simple evaporative cooling yet maintains the lower humidity output of conventional refrigerant cycle air conditioning. The multiple stages produce increased performance so that even on the hottest days air can be cooled sufficiently for thermal comfort. The system also uses a combined evaporative cooler and air-to-air heat exchanger to cool air recirculated from the indoor rooms while avoiding adding water vapor to the indoor air. The "Cool Alternatives" design provides a functional, sustainable, and cost saving solution.

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11:15 – 11:45 a.m.

Title: Audio Compressor/Decompressor

Department of Electrical and Computer Engineering
Project Participants: Joseph B. Greathouse and Benjamin Peacock
Instructor: Dr. Paolo Ginnobi
Faculty Adviser: Dr. Emma E. Regentova

Abstract

Our project is a device that will record, compress, store, decompress and playback a voice signal using a lossy compression technique. This device will convert an analog voice signal to digital data using an analog to digital converter. The data will be compressed using Differential Pulse Code Modulation (DPCM) and stored in a permanent memory device. This data can then be decompressed and converted to an analog signal that will be amplified for the listener using a power amplifier.

The purpose of this project is to create a device that will allow us to use fewer bits to store the audio and still produce a satisfactory reconstruction of the original signal during decompression. By using lossy compression, we are able to simplify the recorded audio by eliminating unnecessary inaudible noises and frequencies and still end up with decompressed audio that is very similar to the original audio.

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11:30 a.m. - Noon

Title: X-10 Phone System

Department of: Electrical and Computer Engineering
Project Participants: Scott DeVoge and David Walker
Instructor: Dr. Paolo Ginobbi
Faculty Advisor: Dr. Paolo Ginobbi and Dr. Venkatesan Muthukumar

Abstract:

The X-10 home automation system has been a standard for do-it-yourself systems. The purpose is to provide a more convenient system for remote access to the controls of a person's home. This project creates a customized X-10 module for the telephone. The X-10 system will receive commands through any two-tone telephone. The X-10 will also identify if the phone number that is calling is in fact the user's, to prevent control of the house from falling to an unauthorized user. The machine will send responses to the telephone about the appliance's status and give the option to toggle the system.

The purpose is to provide a more convenient system for remote access to the appliances of a person's home. The user can access the controls of their home from the user's mobile phone anywhere in the world. The X-10 system would receive commands and send signals through the power lines to the appliances which, for our demonstration, will toggle lights on and off.

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1:15 – 1:45 p.m.

Title: Bio-Fuel Web Manager (BWM)

Department of Electrical and Computer Engineering
Project Participants: Erika Alvarado, Juan Ramirez Navarrete, and Diego Tapias
Instructor: Dr. Paolo Ginobbi
Faculty Adviser: Dr. Paolo Ginobbi

Abstract

Humankind has come to the realization that the world's energy reserves are not unlimited. But there is hope; the smallest creatures on the planet may help solve this problem. Bacteria could be used to convert various materials into fuel to run cars, heat our homes, and even electricity to power our toys.

Microbial fuel cells (MFC) are devices that transform the chemical energy in biomass directly into electrical energy. Dr. Jiang, our mentor, is a member of the University's MFC research team. We designed a device called the Bio-Fuel Web Manager (BWM) that is capable of monitoring the MFC, which would help Dr. Jiang's research.

The BWM is a powerful device that allows users to communicate with the MFC from anywhere on the globe. By using the internet, a person can collect data from the MFC at anytime as well as regulate the MFC's current. Collecting data from the MFC is vital to speed up the study, since it will help determine whether the MFC can be used as an alternate energy source.

The BWM is a flexible, inexpensive, and reliable tool. BWM can be connected/adjusted to any device that needs to be monitored or studied closely, thus releasing the user from the hassle of a physical presence.

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1:30 – 2:00 p.m.

Title: Laser Network

Department of Electrical and Computer Engineering
Project Participants: Vito Esposito, Mike Rawson, and Sruthy Sreekumar
Instructor: Dr. Paolo Ginobbi

Abstract:

Human dependency on computers increased tremendously over the last decade and it is expected to be increasing in the years to come. In efforts to fuel the information revolution, new applications of communication systems are discovered. Most of the existing network traffic travels through cable. In today's wireless world, using a cable for network traffic has several disadvantages. The signals can be easily distorted by electromagnetic interference such as noise. Running a wire is not always a good option, both from financial and maintenance standpoints. In this context, exploring non-traditional ways to communicate efficiently between two computers can play a key role in enhancing the performance of communication devices.

Laser Network is a cross platform point-to-point optical communication system. Using the computer's existing Ethernet card, the laser network modules encode the standard wired Ethernet signal into a modulated laser pulse. This enables a user to seamlessly and securely communicate with a neighboring network without the need to run a wired line. A Free air Laser Network is a natural progression of wireless communications technology.

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1:45 -2:15 p.m. Open

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2:00 – 2:30 p.m.

Title: Insulated Cooking Pot and Range

Department of Mechanical Engineering
Project Participants: Keith Chung and Erik Kalarchik
Instructor: Dr. Brian Landsberger
Faculty Adviser: Dr. Robert Boehm

Abstract

The basic process of cooking with a stove and pot or saucepan has been relatively static for centuries. Although stove technology has progressed with more efficient and attractive cook tops, heat is still applied only to the pot bottom while the sides of the pot, exposed to the air, dissipate a significant portion of the applied heat. The team goal is to increase the efficiency of the heat transfer by maintaining the applied energy inside the intended food.

The approach taken is to add thermal insulation to the sides of the cooking system. This is accomplished by modifying a cook top heater with special insulating sides that are designed to closely hold the pot sides. A parameter optimization experiment was conducted to determine the levels of insulation thickness and height, and pot material to achieve the best balance between thermal efficiency, economy, and convenience to users. Also, the team has designed with readily available, economic and easily assembled components to keep the final price competitive.

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2:15 – 2:45 p.m.

Title: Coach Controller

Department of Electrical and Computer Engineering
Project Participants: Tim Goins, Michael Meevasin, and Chudi Onowu
Instructor: Dr. Paolo Ginobbi

Abstract

The purpose of this project is to improve the efficiency of a training session for college football, but can also be expanded to other sports as well. During practice, the coach will have a schedule of what he wants the team to practice and for how long. The coach will typically have a display board that will display the amount of time this particular session of training will last and a period to indicate the current training session.

The current method requires an assistant to run to the display board and set the time as well as the period. If the coach needs to re-start that particular session, pause the current session, or move onto the next session the assistant again must run to the display board and stop or re-start the time. The amount of time wasted on each run may be small, but adds up over time.

To simplify this and make better use of the limited training time, we plan on implementing a simple remote device that will allow the coach to re-start or stop a training session without the need to have someone continually running to the board and resetting the time.

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2:30- 3:00 p.m.

Title: Miniature Aerial Vehicle

Department of Mechanical Engineering
Project Participants: Thomas Higgins and Rico Picone
Instructor: Dr. Brian Landsberger
Faculty Adviser: Dr. William Culbreth
Community Mentor: Lew Aerospace

Abstract

The Department of Defense has asked for designs of a one-man transportable Miniature Unmanned Aerial Vehicle (UAV) that can carry reconnaissance sensors into dangerous or hostile areas. Current unmanned aerial vehicles are too large and not sufficiently rugged for easy backpack transport by advanced reconnaissance teams. To meet this objective the team has designed a UAV with no dimension greater than six inches that can perform live video feedback. Later product generations could also implement a Geiger counter for radiation detection.

The team has joined with Lew Aerospace, an Unmanned Aerial Vehicle company in Las Vegas, to aid in material, expertise, and follow-on production to develop this product. Project goals are to achieve 200 feet of range, lightweight, rugged, small transportable package size, rapid deployment, and recovery without additional support, and accurate target surveillance. A custom designed flying wing type airframe filled with off-the-shelf miniature aircraft control and reconnaissance components is used. Once basic aircraft stability is achieved, a designed parameter optimization experiment is performed to maximize mission performance. The team vision for this product is for United States military scout and air base security teams to have available for surveillance our Miniature Unmanned Aerial Vehicle.

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2:45 – 3:15 p.m.

Title: Robotic Pellet Mover

Department of Mechanical Engineering
Project Participants: Robert Stephens and Edwin Sutrisno
Instructor: Dr. Brian Landsberger
Faculty Adviser: Dr. Georg Mauer

Abstract

Once spent nuclear fuel pellets are removed from the reactor core, they must undergo several processing steps including picking up each pellet and positioning it in place for arrangement into long tubes. This positioning could be easily accomplished by workers but because the pellets are highly radioactive they must be isolated from people. An autonomous method is needed to perform the pellet positioning, which requires grabbing, manipulating and releasing the pellets. The goal of this project is to develop a device to perform this positioning of nuclear fuel pellets safely, efficiently, and autonomously.

The team developed a robotic gripper hand that can grasp fuel pellets intelligently and reliably. The device uses a linear drive system that moves two robotic grasping fingers. Small switches detect when the gripper has successfully grasped a pellet while limit switches detect when the gripper has failed to find a pellet. The controlling program uses these sensor inputs to limit force on the pellet and to restart the sequence if the pellet is missed. The team used a designed experiment to optimize gripper speed, gripping force, and grasping position. This solution can be used by any nuclear plant for hazardous spent fuel pellet handling.

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3:00 – 3:30 p.m.

Title: Automatic Solar Sunshade

Department of Mechanical Engineering
Project Participants: Solomon Alemayehu and Frederic Tesfay
Instructor: Dr. Brian Landsberger
Faculty Adviser: Dr. Kammal Hossain

Abstract

In regions like the Southwest United States temperatures in the interior of a vehicle can reach 150°F where interior surfaces are painful to touch. Existing manual sunshades help to lower interior temperatures but the devices are tacky in appearance, cumbersome to use and to difficult to stow. The goal of this project is to create a device to lower the surface and air temperatures inside a car that is attractive, easy to use and unobtrusive.

Because of the high quality and safety requirements for automotive systems, the team paid particular attention to meeting customer needs while maintaining a safe and reliable product. The team used mechanically stiffened sun block fabric mounted on a roller tube to create a retractable sunshade that effectively blocks sunlight and thus reduces the interior temperature of a vehicle. The sunshade uses a remote control for ease of operation. The entire sunshade is neatly attached across the top of the windshield taking up only two inches of unused windshield while disengaged. These features allow easy installation into existing cars and also easy inclusion as an original equipment option.

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3:15 – 3:45 p.m. Open

3:30 – 4:00 p.m.

Title: Reverse Osmosis Design

Department of Civil and Environmental Engineering
Project Participants: Christopher Bolton, Donald Maxfield, and Ty Nelson
Instructor: Dr. Walter C. Vodrazka
Faculty Adviser: Dr. Jaci Batista
Community Mentor: Mr. Walter Johnson

Abstract

A continuing concern in Clark County is the availability of water to sustain a rapidly growing population. Infinity Engineering accepted the challenge of helping to provide another water supply in the Las Vegas Valley. Our specific task was to treat 25 million gallons per day (MGD) of tertiary effluent (containing 1500 mg/L of total dissolved solids) and to achieve at least 97.5% water recovery through use of reverse osmosis (R/O) technology.

Our R/O system consists of three stages of membranes, with chemical precipitation used between stages two and three. Our design is projected to achieve 97.8% water recovery. A two and a half acre parcel of Clark County Water Reclamation District property was selected house the RO operation which includes a 60,000 square feet building and an access road. An economic evaluation of construction costs of the facility and R/O system, including operations and maintenance costs, was prepared. The system could be financed with a 20 year bond at an annual interest rate of 6%. Such a bond requires annual debt service of $12,000,000.

In conclusion, we recommend that our facility be built in conjunction with the waterline from the north. If mixed, these two solutions could help to improve the quality of drinking water in the Las Vegas Valley, as well as improve the quality of water in Lake Mead.

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3:45 – 4:15 p.m.

Title: Hunter's Meadow at Idmon

Department of Civil and Environmental Engineering
Project Participants: Derek Harris, Robert Hunter, Brian Kalina, and Raul Valdez
Instructor: Dr. Walter C. Vodrazka
Faculty Adviser: Dr. Jacimaria Batista
Community Mentor: Mr. Bill Hunter, P.E.

Abstract

Property owner Bill Hunter is proposing to develop Hunter's Meadow at Idmon as a combination of single-family housing and commercial development. Approximately 160 acres will be included in the proposed project. The proposed development is located within Clark County, Idaho, and is currently farmland with few permanent structures. The residential portion of the project site is approximately 140 acres consisting of 84 lots, interior roadways, and a walking/horseback riding trail, and a park/riding arena. The commercial portions of the project consist of approximately 7 acres at the southeast corner of the site and 5 acres at the northeast corner of the site.

Rebel Engineering provided the civil engineering services for the project site, including site grading, waste treatment analysis, drainage analysis, traffic analysis, roadway design, and a cost benefit analysis. Further preliminary work must be done before final recommendation can be made including, but not limited to, a topographical survey of the site, water table verification, and a soils report. Accordingly, the conclusions and recommendations set forth by Rebel Engineering are preliminary in nature.

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The Howard R. Hughes
College of Engineering
applauds your efforts!

We look forward to our annual
Senior Design Dinner
Friday, May 7, 2008
at the Cox Pavilion.


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