Pipeline

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CAL POLY COLLEGE OF ENGINEERING

Multidisciplinary design class creates new opportunities

Senior course gives students a powerful edge with industry, helps those in need and spurs innovative technical solutions

CAL POLY ENGINEERING STUDENTS ARE known for their impressive and ambitious choice of projects, but when different majors come together and form multidisciplinary teams, the sky's the limit. Students in this year's Interdisciplinary Senior Design class split into six teams for this three quarter long project. Designs include a robotic hand that will give the deaf-blind population computer access, a ventilation system specially designed to save the lives of premature and sick newborns, and even a self-sustainable, gardening robot.

"It is a valuable experience to work with other engineers. There really isn't an opportunity to work in multidisciplinary teams like this in any of our other classes and this represents the real world."

Bryant Larson,
ME student working on
the Spin Bike Power Meter

All projects are sponsored by companies, organizations or individuals who pay a certain amount to support the students' research and design. Professors from different engineering departments will rotate as advisors for the projects year to year, to promote all departments' involvement in making this program truly interdisciplinary. The 2008-09 advisors — Dr. **Lily Laiho** (BMED), Dr. **Richard Savage** (MATE) and Dr. **Jim Widmann** (ME) — led computer science, biomedical, materials, mechanical, electrical, industrial and general engineering students.

The students produce a conceptual design which they present to their sponsors during a regularly scheduled design review. Then they make a detailed design and manufacture it. After testing they make modifications and present it at the CENG Design Expo. "Engineers need interdisciplinary teams when they are working," said faculty advisor and BMED professor, Dr. Lily Laiho. "In the MD Design class I have noticed a lot more student interaction and they are starting to learn to do a bit of everything."

Materials Engineering students **Tony Le** and **Chris Harrington** and Mechanical Engineering students **Adam Overton**, **Evan VandenBrink** and **Bryant Larsen** under faculty advisor Dr. **Richard Savage**, have come together to work on the spin bike power meter. They have produced a low cost technique for calculating power on an exercise bike. Measuring power has become widely accepted as the most accurate way to determine actual physical exertion during an exercise.

This technology will make it possible for health clubs and private homes to have spin bikes with power meters, making exercise regiments more accurate and consistent from day to day. Together, power and heart rate can be used to determine overall fitness improvements.

The power meter works by using measurements of force and angular velocity or RPMs to calculate work, which gives you power. A Piezo-electric resistor sensor measures force to the fly wheel and a hall-effect sensor measures rotational speed. The cost of materials for the device is $25.53 with an estimated wholesale price of $75 and a retail price of $150. This is a stark

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Robotic Finger-Spelling Hand

ASSISTING THE DEAF AND BLIND — Sponsored by the Smith-Kettlewell Eye Research Institute, the Robotic Finger-Spelling Hand project had Cal Poly Engineering students developing a second-generation hand that can form the letters of a one-hand manual alphabet, making it possible for deaf-blind individuals to receive communication from anyone who can type. The project also provides deaf-blind people who don't read braille with computer access for the first time. Above: Professor Saeed Niku, left, and Mario Garcia, point out the features of their hand design. "This hand is lightweight and smaller than previous designs so it's more portable and practical," Niku says. "We showed the hand at an expo in June and received many positive comments."

Solar RoboTrimmer

SOLAR FARM LANDSCAPING — The challenge for this multidisciplinary project sponsored by OptiSolar, Inc. was to build an automated lawnmower capable of handling thick brush and grass without damaging solar panels and without producing large quantities of dust. Above: Materials engineering student Juan Jimenez works on the robotic mower designed for OptiSolar's proposed Topaz Farm solar farm project on the Carrisa Plains.

Spin Bike Power Meter

MEASURING THE BURN — Six engineering students produced a low-cost technique for calculating power generated on an exercise bike. The project is sponsored by Nano Scale Surface Systems and makes exercise regiments more accurate and consistent.

Mechanical engineering graduate student Bryan Edwards holds up his carbon-fiber "e-glass" propellor he designed for the Cal Poly Wind Power project. The student-designed wind turbine will be erected on Cal Poly's Escuela Ranch property.

Cal Poly's wind power project is picking up speed

THESE DAYS, IT'S EASY TO SEE THE WINDS OF change at Cal Poly Engineering.

Professors **Patrick Lemieux**, **John Ridgley** and **Joe Mello** have spearheaded the creation of the Cal Poly Wind Research Center and have involved nine mechanical engineering students in the development of technology that could affect the world's energy future. The students are designing and building a 3-kilowatt wind turbine that will power a water pump on Cal Poly's Escuela Ranch. Based on a commercial wind turbine designed by ME alum **Dean Davis**, the project involves engineering the complete package: propellor blades, 70-foot tower and the "nacelle," which holds the generator.

The group built an 80-foot tower on the ranch to measure wind speed and direction and were surprised at gusts up to 75 mph. "We have measured some pretty amazing wind speeds up on Escuela Ranch," Lemieux says. "It has proven to be an ideal site."

The project, which included **Alvaro Martinez**, **Bryan Edwards**, **David Nevarez**, **Zachary Taylor**, **Devin Gosal**, **Christopher Nosti**, **Francisco Martinez** and **George Katsanis**, and is sponsored by the California Central Coast Research Partnership and the Chrones Chair of Mechanical Engineering, is central to the Wind Research Center's mission of training graduate and undergraduate engineering students for utility scale wind energy jobs.

"Our students are already collaborating with industry leaders, using proven results to benchmark their own work," says Lemieux. "It's all in the best tradition of 'Learn by Doing." ■

ME students David Nevarez, Zachary Taylor and Alvaro Martinez display the "nacelle" portion of the Cal Poly wind turbine project sponsored by the California Central Coast Research Partnership and the Chrones Chair of the ME Department.

Multidisciplinary from Page 1

difference from current power meters which are much more expensive. The SARIS power meter hub ranges from $800-$2,900, and the SRM power meter crank can cost between $2,800 - $3,900.

"We are developing a new product and we get to see it marketed from start to finish as we take a concept and bring it into fruition," said **Evan VandenBrink**.

The team is sponsored by Nano Scale Surface Systems (NS3) and has been working closely with **John Felts** to develop the product which NS3 and Felts plan on licensing to companies. They meet with Felts once a month, he is in contact with companies who are potential buyers and passes on their input to the students. NS3 gave the team a budget of $3,000, but the team has run an efficient design and production and only used $1,000 of that.

"We are developing a new product and we get to see it marketed from start to finish as we take a concept and bring it into fruition."

Evan VandenBrink, ME student working on the Spin Bike Power Meter

Although the team was multidisciplinary, they said their biggest challenge were issues related to electronics and they could have used an electrical engineer. However being part of a multidisciplinary design class, they had a lot more help and were able to get advice from EE's in other groups.

"It is a valuable experience to work with other engineers," said **Bryant Larsen**. "There really isn't an opportunity to work in multidisciplinary teams like this in any of our other classes and this represents the real world."

The team said they were also attracted to this Multidisciplinary Design class because they knew their project would be more complex than if they were only working with resources and brainpower from one discipline. This class is an alternative to a single-discipline senior project for all five members of the team who were glad they took the opportunity.

Larsen, Le and VandenBrink graduated in June, Harrington and Overton are graduating in December. Le plans on spending two months in Asia after graduation, but when he gets back and starts to look for jobs he says his dream is to work for a bicycle company. He is hoping his involvement with the spin bike power meter will give him an edge.

Other projects include new gaming technology for joystick-controlled wheelchairs. The team has created attachments for Universal Play Frames which will let participants drive around and shoot foam balls through hoops attached to other wheelchairs. They have had to develop technology for electronic scoring and automatic ball retrieval. (See photos on Page 5).

There is also a team working under sponsor, Boston Scientific, which has been developing a permanently implantable anchoring device for spinal cord stimulation which could give relief to those in chronic pain. Another project aims to reinvent a medical device for the mechanical ventilation of premature and sick newborns.

The Solar RoboTrimmer project sponsored by OptiSolar created a robotic system that can navigate between rows of photovoltaic panels and regularly cut down plant growth that might grow to block sunlight. The goal is to eventually be able to maintain an entire solar energy farm with a team of robots without needing an on-site maintenance crew. The RoboTrimmer is being designed specifically for OptiSolar's proposed Topaz Solar Farm on the Carrisa Plains, which would generate 550 megawatts of electricity. If built, the facility would cover roughly 9.5 square miles and would be the world's largest photovoltaic solar farm

Another robotics project sponsored by the Smith-Kettlewell Eye Research Institute had students developing a second-generation hand that can form the letters of a one-hand manual alphabet, making it possible for deaf-blind individuals to receive communication from anyone who can type. This could provide computer access for the first time to the many individuals who don't understand Braille. ■

Cal Poly students' project is a crash-course in avoiding crashes

Stephane Roussel (ME) works on his Sensor Integration For Truck Crash Avoidance System mounted behind the cab of a Cal Poly truck.

WHEN YOU'RE DRIVING A BIG RIG TRUCK, another pair of eyes out the back sure would come in handy. Three Cal Poly mechanical engineering students developed a crash avoidance system based on that simple idea that earned them an invitation to Stuttgart Germany to compete in the International Student Design Competition at the 2009 Enhanced Safety of Vehicles Conference.

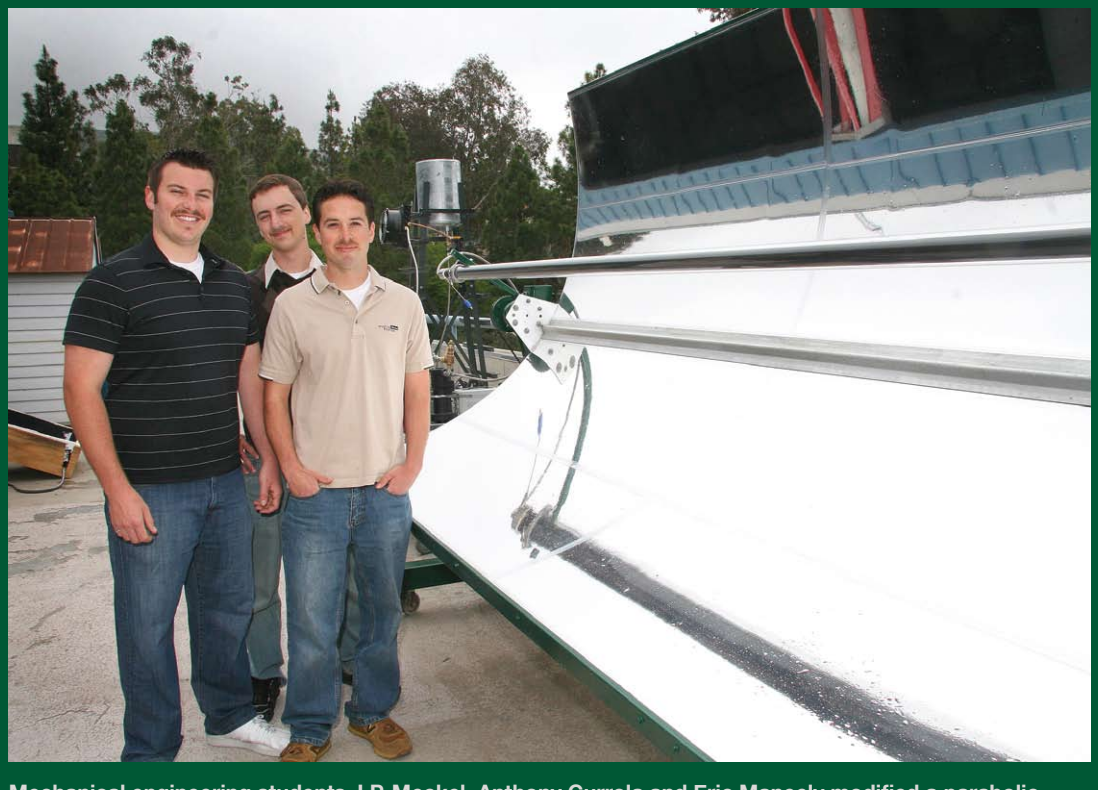
Working with professors **Charles Birdsong** **Peter Shuster** and **Hemanth Porumamilla**, **Stephane Roussel**, **Mario Garcia** and **Joey Marino** were invited to Germany after winning the North American regional competition with their design of a Truck Crash Avoidance System.

"The system integrates different types of low-cost sensors with an intelligent algorithm to provide big rig truck drivers with enhanced information about their surroundings especially behind the vehicle and in blind spots," says Birdsong.

The student's project was sponsored by the National Academies, Traffic Research Board. ■

Mario Garcia, Stephane Roussel and Joey Marino traveled to Stuttgart, Germany, to compete in an international design contest with their Truck Crash Avoidance System.

ME students develop a solar-powered steam engine



Mechanical engineering students J.P. Meckel, Anthony Gurrola and Eric Maneely modified a parabolic concentrator to collect sunlight for steam-powered electric generator.

***SUN + WATER = POWER:** Fueled by an anonymous sponsor who donated $10,000 to inspire work in solar energy, three mechanical engineering students developed a steam engine powered by the sun.*

J.P. Meckel, Anthony Gurrola and Eric Maneely built the engine by modifying an existing solar parabolic concentrator they found in the Thermal Science Laboratory, purchasing a new 100-watt piston-cylinder steam engine, and designing a system to power an electric generator.

"This project was a great learning experience for our team, not only from a technical standpoint — power generation, heat transfer, solar power, etc. — but also from a more general project experience," said Meckel. "We saw the value of actually producing a design. Just because something works on paper does not mean it will be the same in reality.

"It's been interesting to work on a project where the professors don't know all the answers. It was up to us to figure out how to make the system work." ■

2008-09 Sponsored Research

A sampling of sponsored faculty projects:

Multidisciplinary

■ Model of Cartilage Growth Biomechanics: The National Institutes of Health has sponsored a project by Dr. **Stephen Klisch** (ME) and **Scott Hazelwood** (BMED) to develop tissue engineering strategies for the repair of arthritic articular cartilage. These novel repair strategies may one day be used to replace arthritic cartilage and help stave off arthritis progression and more costly joint replacement strategies at later stages of the disease.

■ Lowering the Cost of Algae Biofuel through Synergies with Wastewater Reclamation; Production of JP-8 Fuel Precursors from Algae Biomass: A project in collaboration with the City of San Luis Obispo Wastewater Reclamation Facility and funded by the Office of Naval Research through the California Central Coast Research Partnership (C3RP) by Drs. **Tryg Lundquist** and **Yarrow Nelson** (CE/ENVE), and Drs. **Mark Moline** and **Corinne Lehr** (Biological Sciences).

Aerospace Engineering

■ Physical Properties of Orbiting Objects: Dr. **Kira Abercromby** is working with Jacobs Technology on a NASA project to determine physical characteristics of orbiting objects to be used within models to predict the future environment of objects.

■ Integrated Modeling and Verification of Hybrid Wing-Body, Low Noise ESTOL Aircraft: Dr. **David Marshall** received second-year funding from NASA - Langley Research Center for this multi-year project to develop a modern, integrated aerodynamic/propulsion/ structural/control tool for testing short takeoff and landing (STOL) aircraft.

■ A multidisciplinary geometry based framework connecting design, optimization, aerodynamics, and structures: NASA renewed Dr. **Rob McDonald**'s three-year, $1M grant to develop a multidisciplinary analysis and optimization (MDAO) software framework that will facilitate the design of future aircraft.

Biomedical and General Engineering

■ Bio-Markers in Sweat: The Defense Advanced Research Projects Agency (DARPA) engaged Dr. **David Clague** in a $100K project to develop surreptitious approaches to the collection and assay of sweat samples.

■ Disease Biomarker Detection: A BioMEMS Approach: Epson funded Dr. **David Clague** to Develop point of care (poc) instrumentation that could not only be used in the hospital but in the home. The Cal Poly team efforts involve both modeling and actual devices.

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Project-Based Learning

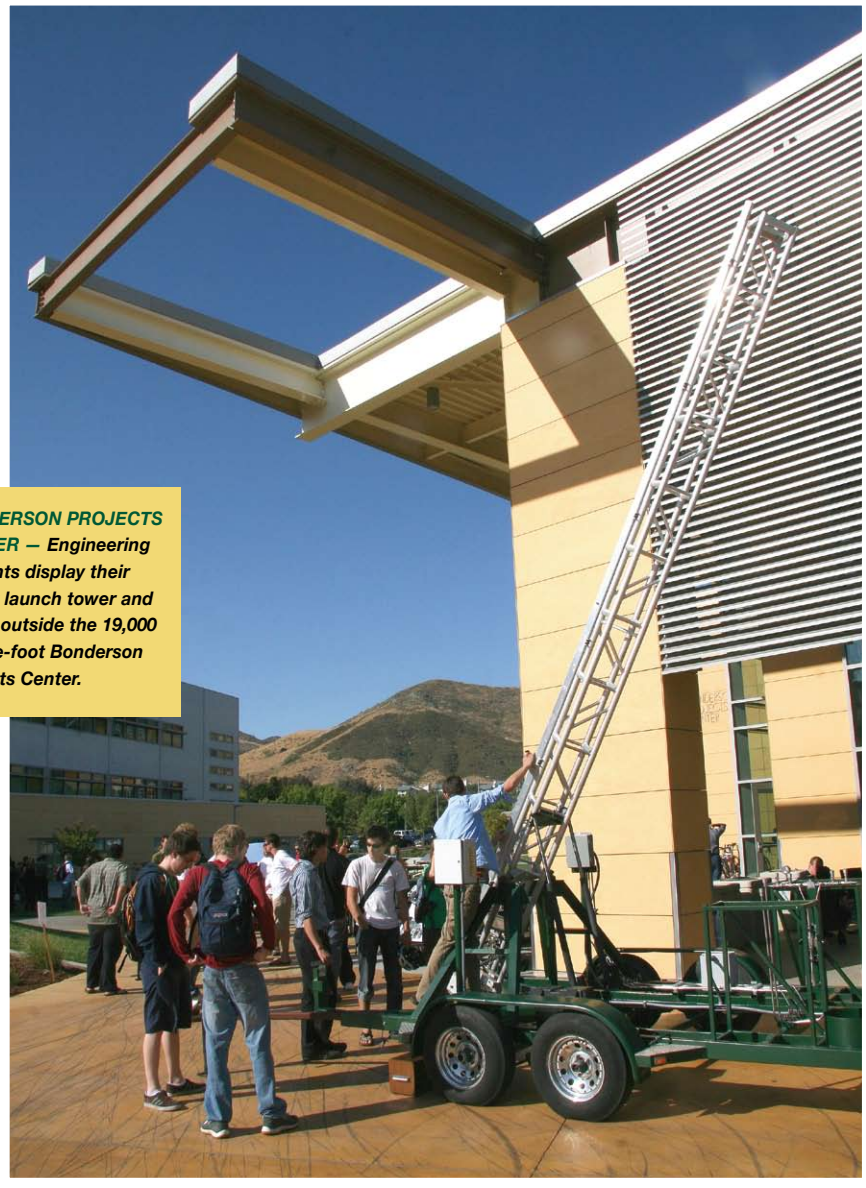
Taking "Learn by Doing" to the next level

IN A SENSE, THE CAL POLY COLLEGE OF ENGINEERING HAS ALWAYS BEEN DEDICATED to hands-on project based learning. Literally set in stone with the construction of the Bonderson Projects Center in 2008, the college's new emphasis on Project Based Learning is opening new opportunities for industry involvement.

"The rich engagement that our faculty and students have with industry and applied research fosters innovation — it's an innovation 'incubator,'" says dean **Mohammad Noori**. "If alumni and industry bring us great ideas and projects, and provide the seed money for development, prototyping and commercialization, we can move 'Learn by Doing' to the next level."

Dean Noori sees students working on projects specifically suggested by industry as enhanced preparation for their first jobs. "As we grow the number of industry sponsored projects, students have more and better opportunities for exposure to real world engineering, and they are better prepared," he says. "By interacting directly with industry professionals, students have a chance to identify career paths. Of course, the benefits cut both ways: the projects enrich recruitment opportunities for industry representatives, who get a preview of excellent candidates for employment."

The dean also sees "social connectivity" as part of the new emphasis on project-based learning. "At Cal Poly Engineering, we recognize that engineers have a special responsibility to address our global challenges—challenges that offer enormous engineering opportunities," Noori says. "Our vision, therefore, is to leverage project-based learning to foster innovation and to educate a new type of engineer, one with social awareness. We offer projects undertaken in conjunction with industry or projects that meet the real needs of non-profit and community clients. That means that when our students graduate, they already have developed project management and entrepreneurial skills. It's an enormous advantage." ■



BONDERSON PROJECTS CENTER — Engineering students display their rocket launch tower and trailer outside the 19,000 square-foot Bonderson Projects Center.

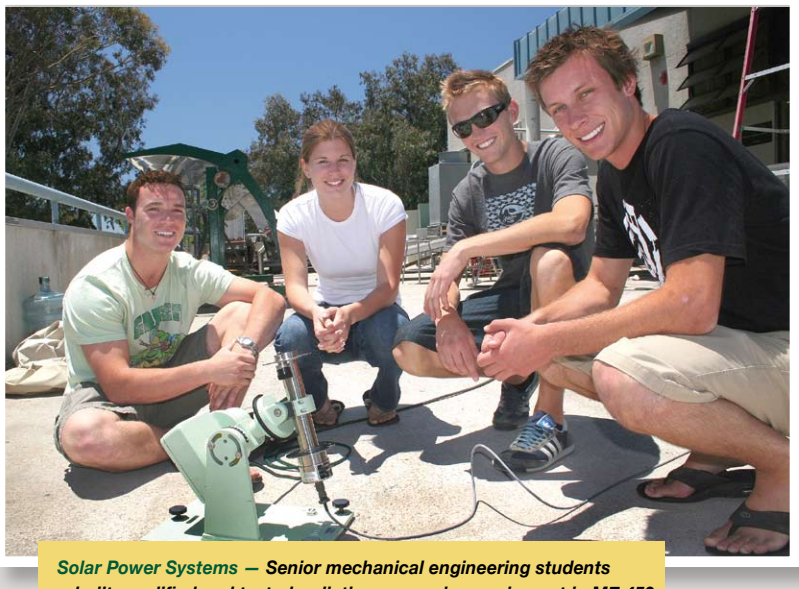
A sampling of projects from 2008-09:

HAND-POWERED REAR-WHEEL-DRIVE WHEELCHAIR ATTACHMENT — In a joint project with Hoschule Munchen University in Munich, Germany, Cal Poly engineering students Colin Neunuebel, Bjorn Sorenson and Lazer Vandenhoek designed a rear-wheel drive attachment for a wheelchair that is powered by a hand crank.

SOLAR ROBO TRIMMER — Sponsored by Optisolar and intended for it's proposed Topaz Solar Farm on the Carrisa Plains, six engineering students designed a robotic mower which will trim vegetation growing between the photovoltaic panels.

BIODIESEL FROM ALGAE — Students Bryan Brooker (GENE) and John Karamanlis (ENVE) examine the growth rate of algae in the Algae-Biodiesel Project (BRAE).

AUTONOMOUS UNDER-WATER VEHICLE (IVER2) — Using the new swimming pool at Poly Canyon Village as a lab, students programmed an autonomous underwater vehicle.



Solar Power Systems — Senior mechanical engineering students rebuilt, modified and tested radiation measuring equipment in ME 450 (Solar Power Systems) during Spring quarter. Above: Sean Stamm, Claire Shubert, Weston Cooke and Colin Gibbs measure the direct beam radiation from the sun using an Eppley Normal Incident Pyroheliometer. Below: Chris Hornberger, Andrew Carmean, James Fortner and Adam Gruver check out the radiation readings from a Mechanical Pyranograph.

RAMMED-EARTH BLOCK PRESS — Mechanical engineering students Scott Antista and Stephanie Heil developed a rammed-earth press that forms construction blocks. The press was designed to help rebuild a village in Thailand.

GOLF BALL CHIPPER — The team of students working under professor Tom Mase on a Golf Ball Chipper included Jacob Swatz, Kevin Ebberts, Samson Holmes, and Kevin Swanson. The robotic chipper allows golf clubs to be tested without human variation in swing speed and direction.

FOAM WARS PLAY FRAME — Working with Special Olympics, six engineering students designed a "Foam Wars" attachment for a universal play frame (UPF) that allows wheelchair athletes to fire foam balls at each other. The project included Garth Will Young (MATE), Adam Hudson (ME), Kevan Turner (MATE), Jenee Hughes (SE), Ruben Garcia (BMED) and Vikramaditya Mediratta (BMED).

2008-09 Sponsored Projects

■ The Genomics of Injury-Repair: A project funded by the Office of Naval Research through the California Central Coast Research Partnership (C3RP) by Dr. **Trevor Cardinal**.

Civil & Environmental Engineering

■ Development of LNGTEMS/MOTEMS Performance-Based Seismic Criteria: California States Lands Commission (CSLC) sponsored a project by Dr. **Rakesh Goel** to determine seismic demand and structural capacity for piers/wharves on concrete or steel piles.

■ Innovative Learning Styles and Universal Access for Geotechnical Engineering: Dr. **James Hanson** is collaborating with Auburn University on this National Science Foundation (CCLI) project to improve student learning, which will include student-developed learning modules designed for universal accessibility.

■ California Integrated Waste Management Board Studies: Two $150K studies will help determine the appropriate level of regulatory oversight for recycling centers, transfer stations, and green material, and cost effective strategies for minimizing long-term post-closure maintenance costs at California landfills.

■ Biogas Generation from Algae Biomass: The California Energy Commission Energy Innovations Small Grant Program provided funds to Dr. **Tryg Lundquist** to demonstrate the practicality of producing energy from algae from large wastewater pond systems.

■ Risk of Levee Failures: Dr. **Robb Moss** is working under grants from the U.S. Department of Homeland Security and the National Science Foundation to analyze the potential for failure of the Sacramento-San Joaquin Delta levees, which are critical to California's water distribution system. The risk-based model he produces will help focus mitigation dollars on the most critical weaknesses of the levee system.

■ U.S. – China collaborative soil-structure-interaction research: This C3RP project by Dr. **Robb Moss** involves an international research partnership.

■ Evaluation of the Crack, Seal, and Overlay Method: This Caltrans-funded research by experts Drs. **Ashraf Rahim** and **Gregg Fiegel** will help determine the most efficacious and cost-effective method to repave and rehabilitate thousands of miles of concrete roads.

■ Ribbed Sandwich composite panels for naval applications: This C3RP project by Dr. **Mitra Nilanjan** with Dr. **Eric Kasper** involves a novel technique for improving shear resistance and reducing delamination of composite skin from foam core.

■ Sustainable Reuse of Corrugated Board for Civil Engineering Applications: A project funded by the Office of Naval Research through the California Central

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Patent portfolio continues to grow at Cal Poly Engineering

CAL POLY'S RESEARCH AND GRADUATE PROGRAMS OFFICE has reported that two of its pending patent applications have received formal notice of approval from the United States Patent and Trademark Office.

The first patent, "Field Water Purification System," is a lightweight water-treatment system for field environment water purification. It was designed particularly for use in the wake of major disasters, when access to clean drinking water is critical.

Trygve J. Lundquist, assistant professor of civil and environmental and engineering invented the technology. The purification system improves three vital steps in the provision of potable water in disaster relief – the transport, treatment and safe storage of the water.

The low-cost, compact design is superior to treatment systems currently used, such as 5-gallon containers air-dropped to sites, iodine tablets, hand-pumped filters, and various high-tech, high-cost devices. The design integrates techniques used at water-treatment plants into a personal water bag that enables collection, treatment, transport and storage in a single unit. The current design can treat enough water to supply a family of five for up to 10 days.

Potential users of the product may include the U.S. government agencies such as FEMA and the National Guard and international relief organizations such as the Red Cross/Crescent, UNICEF, USAID, and CARE — all of which serve tens of millions of disaster survivors each year.

In fall 2008 Cal Poly graduate student **Tricia Compas** was awarded $14,500 from the Clinton Global Initiative and the Wal-Mart Foundation for her work testing the effectiveness of the purification system

The second patent, a "Procedure for RFID Tagging of Reusable Plastic Containers (RPCs)," identifies and tracks reusable plastic containers and their contents. By employing radio frequency identification (RFID) the tags can be read in a variety of environments when barcodes and other optical technologies are not options. They can also be equipped with sensors that significantly improve tracking food shipments.

The technology was invented for the agricultural industry by **Tali Freed**, director of the Cal Poly multidisciplinary center Poly-GAIT (Global Automatic Identification Technologies).

By tracking food routes — from the grower/processor, to the distribution center, and to the retail store — RFID technology can provide a traceable audit trail for contaminated foods, thus leading to new standards in food safety and quality.

Once issued, these patents will add to the university's current portfolio of 11 patents and nine patents pending. Licensing opportunities are available through the offices of the California Central Coast Research Partnership (C3RP) at www.c3rp.org for patents held in the university's portfolio.

For more information, contact **Jim Dunning**, C3RP Project Administrator, at 805-756-5551 or jdunning@calpoly.edu. ■

Polytech Waterbag Team

Cal Poly's Polytech Waterbag team, at top, which recently received a patent for its "Field Water Purification System," included: Tricia Compas, (CE/ENVE), Maggie Herzog (ENVE), Stephen Barr (ENVE), Adam Wegener (IME), Casey Kelleher (ENGR), Kylie Hensley (ENVE), Tomiko Oden (GRC), and Chris McCann (BUS). Not pictured: Morgan O'Hare (ENVE) and faculty adviser Tryg Lundquist.

In the above photo, Wegener holds the newly patented filter he designed for the Polytech Waterbag, which can treat enough water to supply a family of five for up to 10 days. Potential users of the waterbags include FEMA and international relief organizations.

Cal Poly's Team Tech gears up for another big win

LOCKHEED MARTIN AEROSPACE COMpany has teamed up with Cal Poly students to produce a cost-effective system to measure hinge moments of aircrafts in a wind tunnel.

Besides producing a quality device for Lockheed Martin, the team also hopes to win Team Tech, a national design competition. It is hosted by the Society of Women Engineers (SWE) and will take place next October at the SWE national conference. At the conference they will be evaluated on the team's ability to work together, use of the engineering process, the final product, quality of results, and the ability of the team to work with industry.

Last year Cal Poly won second place at Team Tech for their redesign of a surgical system for Stryker Endoscopy. In 2007 they won first place when they teamed up with Walt Disney Imagineers to design a roller coaster weld point inspection device.

Nadia Shraibati, a Cal Poly Team Tech director, says the team is confident they will do well at the competition, however that is not the only goal. "With this program, SWE hopes to introduce students to a hands-on experience of the engineering design process," Shraibati says. "Regardless of how we place in nationals, we gain an invaluable amount of knowledge and experience through the project."

Team directors have weekly phone conferences and quarterly design reviews with their advisors from Lockheed Martin. "Our advisors are enthusiastic and supportive of our project and provide a professional perspective when evaluating our design," said Shraibati. "They ask questions that we as students might not have considered and give input based on their past project experience."

LOCKHEED MARTIN

The team is comprised of undergraduate engineering students from all grade levels and from seven different engineering disciplines. They are divided into four teams, each working on a different section of the design; measurement system, attachment system, electronics system and testing.

Shraibati said the biggest challenge is making sure different sections of the team are communicating clearly to make a consistent design. They tackle this potential pitfall by having weekly meetings with representative from each design section. Effective communication is necessary to ensure a consistent design when they manufacture and assemble the final product. ■

ME students bring water technology to developing countries

TEN CAL POLY ENGINEERING STUDENTS ARE FOCUSING on a problem that affects at least 1.1 billion people — access to safe drinking water. The students are designing a drill that can produce water wells on small plots of land in rural villages of developing countries.

Sponsored by a $15,000 grant from the San Luis Obispo Monday Rotary Club, the project aims to bridge the gap between the sophisticated technology in developed countries and the inefficient, low-technology methods used in developing nations. The final product had to be inexpensive, easy to transport and made with some materials available in the country.

"The Rotary Club of San Luis Obispo has done a water project in Malawi and understands the great need for clean water in bringing health and prosperity to the most impoverished," says Rotary Club member Tim Cleath. **Matt Spence**, a member of the student design team, adds, "The idea is to reduce the overall cost of current water wells and provide water to more villages and people than possible before."

Mechanical Engineering student **Steven Mitzel** says the students were initially divided into three separate teams: "Team Rock-It focused on hard rock drilling, while the Waterboys Team looked into alluvial soil drilling. The Monax Groundwater Drilling Team was in charge of creating a power source that could assist in the drilling process and be utilized in remote areas. This would avoid having to drill the wells by hand."

While the wells won't be hand-drilled, Mitzel says pumping the wells will be hands-on. "The water well project envisions the installation of small hand-pumped water wells on small plots of land that provide substinence food production in rural villages within developing countries throughout the world." ■

Water Well Drilling System

Working with the direction of faculty advisor Frank Owen, the three teams of students working on the drill were comprised of: Monax Groundwater Drilling: Steven Mitzel (ME), Ivan Tomazin (ME), Spencer Kreikemeier (ME) and Joshua Heinrichs (ME); Team Waterboys: Matt Davis (ME), Brendan Ochoa (CE) and Joe Engel (ME); Team Rock-It: Matt Spence (ME), Andrew Power (ME) and Nicole Essex (CE).

2008-09 Sponsored Projects

Coast Research Partnership (C3RP) by Dr. **James Hanson**.

Computer Science

■ Redesigning Introductory Computing: In conjunction with Adelphia University, Dr. **John Clements** provided a workshop on a radically new approach to teaching object-oriented programming in introductory courses.

Electrical Engineering

■ High-speed wavelength-swept single chip turnable lasers and their applications to high speed optical test and measurement solutions: The goal of this project sponsored by Global Test and directed by Dr. **Dennis Derickson** is provide detailed understanding of the features and limitations on very high speed laser frequency ramp rates.

■ Enhancement and Operation of V2DVS Automated Data Collection and Analysis System: Under a $150K grant from Caltrans, Dr. **Art MacCarley** is utilizing the Video Vehicle Detector Verification System (V2DVS) in a California highway testbed to evaluate Sensys and Wavetronix and other detectors.

■ Synthetic Aperture Radar Automatic Target Recognition for Ground Targets: Since 2003, Raytheon has funded work to develop Synthetic Aperture Radar Automatic Target Recognition (SAR ATR) for Ground Targets technology. In the coming year, Dr. **John Saghri** will work with students to assess and improve the performance of preliminary SAR ART systems currently developed.

■ Machine-based pattern recognition for noisy and ambiguous domain applications: A project funded by the Office of Naval Research through the California Central Coast Research Partnership (C3RP) by Dr. **Fred DePiero**.

■ Full Band Wavelenght-Swept SGDBR lasers with MHz Update Rates – Sensing and Measurement Applications: A project in collaboration with dBm Optics and funded by the Office of Naval Research through the California Central Coast Research Partnership (C3RP) by Dr. **Dennis Derickson**.

Industrial & Manufacturing Engineering

■ Warehouse RFID Project: Under the direction of Dr. **Tali Freed**, a team of Cal Poly students and faculty implemented a Radio-frequency Identification (RFID) system to improve inventory visibility and save manual labor time at PG&E's Diablo Canyon Nuclear Power Plant warehouse.

■ Proof of Concept, Clips for Football Helmet: Krypton Sports funded a $10K project by students to redesign the clips that hold the visors on football helmets. The goal is to make it easier for players to attach and remove the visors, while providing the same high level of safety.

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2008-09 Sponsored Projects

Mechanical Engineering

■ Thermal Management of Avionic Systems: As part of their senior design class, ME students focused on the feasibility of using conduction as the primary heat removal mechanism for avionic systems. The $25K project was sponsored by Boeing.

■ Role of Faculty in Supporting Lifelong Learning: Under a $78K grant from the National Science Foundation, Dr. **John Chen** is studying how instructors can affect student development as self-directed learners, an attribute that is vital to success in today's engineering environment.

■ Development of a Sonic IR Research Instrument: Sonic IR, a promising new technique to detect cracks in materials has been found to cause fatigue cracks. The National Science Foundation has provided a grant to Dr. **John Chen** to develop a new Sonic IR instrument that avoids this problem.

■ Cal Poly Wind Power Center: Composite Rotor Development: A project in collaboration with Continental Windpower, Inc. and funded by the Office of Naval Research through the California Central Coast Research Partnership (C3RP) by Drs. **Patrick Lemieux**, **John Ridgely** and **Joe Mello**.

■ Boundary Layer Data System Development: To reduce the risk of future flight tests, Northrop Grumman has funded several projects led by Dr. **Russell Westphal** to improve specialized avionic instruments known as the Boundary Layer Data System (BLDS).

Multicultural Engineering Program

■ The MESA Schools Program (MSP): Because students from low-income populations are less likely to select educational paths that prepare them for college, MSP at Cal Poly works with middle and high school students to enhance their academic foundations in applied scientific and mathematical principles, increase their knowledge of careers and technology, and expand their educational horizons to include college as a viable educational option.

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CAL POLY ENGINEERING

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LEED leader: Student works on improving straw building blocks

CENVE professor Dan Jansen, left, and grad student Robbie Camann hoist Stakblocks made from rice straw before conducting seismic tests on campus.

INSTEAD OF GOING FOR THE GOLD, civil and environmental engineering graduate student **Robbie Camann** is working on a project that could take home the platinum. And when you're talking LEED construction, that's a good thing.

LEED (Leadership in Energy and Environmental Standards) certification measures building sustainability—it is designed to promote design and construction practices that reduce the negative environmental impacts of buildings. LEED ranks buildings according to metrics that include sustainable materials, energy savings, water efficiency, CO2 emissions reduction and improved indoor environmental quality.

Camann's project — which he calls "straw bale construction 2.0" — has involved testing the design and seismic performance of walls made with composite rice straw building blocks. His project fits into the LEED rating system beautifully.

"A structure made of rice straw blocks would be LEED Platinum, the highest rating, because you'd get points for diverting waste, for greater insulation, for energy efficiency, and even, as we're finding, for seismic protection," Camann says. "The Stakblock potential for LEED points is huge."

Camann says the Stakblocks he's testing are environmentally sound from the beginning because they are made from leftover straw from harvested rice plants that farmers, who burned it off before air quality laws prohibited the practice, now have to pay to have removed from their fields.

"My work will help a lot in getting the Stakblocks accepted as a building code material — the mass marketing could be five years down the road," says Camann, who spent two years in industry as a structural design engineer. "I came to Cal Poly to learn more about LEED-certified building design, so this project is perfect." ■