Pipeline

Project Based Learning Institute

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CAL POLY COLLEGE OF ENGINEERING

Dean Noori: PBLI moves "Learn by Doing" to the next level

Industry partners sponsoring multidiciplinary, team-based projects are the key, he says

PIPELINE SAT DOWN WITH COLLEGE of Engineering Dean Mohammad Noori in late summer to discuss the Project Based Learning Institute:

Pipeline: We've had a project-based learning environment at Cal Poly's College of Engineering for quite some time. How is it evolving now?

Dean Noori: We are bringing project-based learning to the next level in three ways:

First, we emphasize multidisciplinary and team-based projects. Not only does the Project Based Learning Institute (PBLI) put together multidisciplinary student and faculty teams to undertake industry-sponsored projects, but this fall we also launched a pilot program for a Multidisciplinary Senior Design/Capstone Sequence, as far as we know, the first multi-disciplinary senior project program at any major university.

So, "multidiscipline" is one important way we are evolving. Second, because PBLI provides an enhanced interface and project pipeline for both alumni and industry, we can offer a wealth of real engineering projects to our students and applied research opportunities for our faculty.

And, third, PBLI is project-based learning on steroids, serving as an engine for innovation and product realization. The rich engagement that our faculty and students have with industry and applied research via PBLI fosters innovation. And I envision that, as an innovation "incubator," PBLI can lead to commercialization of exciting new products. 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.

How does the opportunity for students to work on projects specifically suggested by industry enhance their preparation for their first jobs?

That's easy. 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. By interacting directly with industry professionals, students have a chance to identify

Please see DEAN NOORI on Back Page

Down to the sea in an adapted ship

CENG students, professors and quadriplegic social science alum test high-tech adaptive kayak

AS A TEEN, CAL POLY ALUMNUS Bryan Gingg (Social Science, '90) enjoyed swimming, surfing and paddling a kayak in the waters around Morro Bay Harbor. But a 1982 car accident left the Morro Bay resident paralyzed without the use of his arms or legs, ending his love affair with ocean sports.

With the help of Cal Poly engineering and kinesiology students and professors, Gingg was back in the calm blue water of Morro Bay Harbor in mid-May.

Gingg was the test pilot for the "solo quad" kayak developed in Cal Poly's adaptive paddling program. He used a mouth-held electronic "straw" to control a small electric motor on the kayak and to the cheers of dozens of students, media members and supporters, piloted the craft smoothly through the harbor for about 30 minutes.

Starting with an $11,000 grant from the Christopher and Dana Reeve Paralysis Foundation in 2002, the project was developed by Mechanical Engineering Professor Frank Owen and Cal Poly Kinesiology Professor Kevin Taylor.

Mechanical, computer and electrical engineering students worked on the high-tech, outrigger-equipped kayak, which also includes a joystick feature for paraplegic users — those with movement in their arms. Quadriplegic kayakers can sip or puff on the straw to send signals to the kayak's sensor controls and operate the craft. ■

Bryan Gingg (B.S., Social Sciences '90) smiles before piloting an adaptive kayak from a launching ramp in Morro Bay harbor. Middle above: Computer engineering students Brian Smith and Frank Sanchez are two of the CENG students that have worked on the Solo Quad-Conversion Project since 2002. At left: Gingg, a quadriplegic since 1982 as the result of a car accident, guided the adapted kayak through the harbor by sipping or puffing into an electronic "straw" that controls a small electric motor.

Materials engineering student Dan Marrujo works with Raytheon on a project that aims to improve the efficiency of photovoltaic cells found in solar panels through quantum dot technology. Below: A closeup image of a thin film of quantum dots, or tiny nanoparticles, suspended in micro fluidic channels.

PBLI brings industry and innovative students together

LITTLE MORE THAN A YEAR AFTER ITS INCEPTION, THE Project Based Learning Institute (PBLI) has forged many partnerships, enabling Cal Poly engineering students to solve problems and deliver results for engineering firms across several industries.

Discovering the power of Quantum Dots

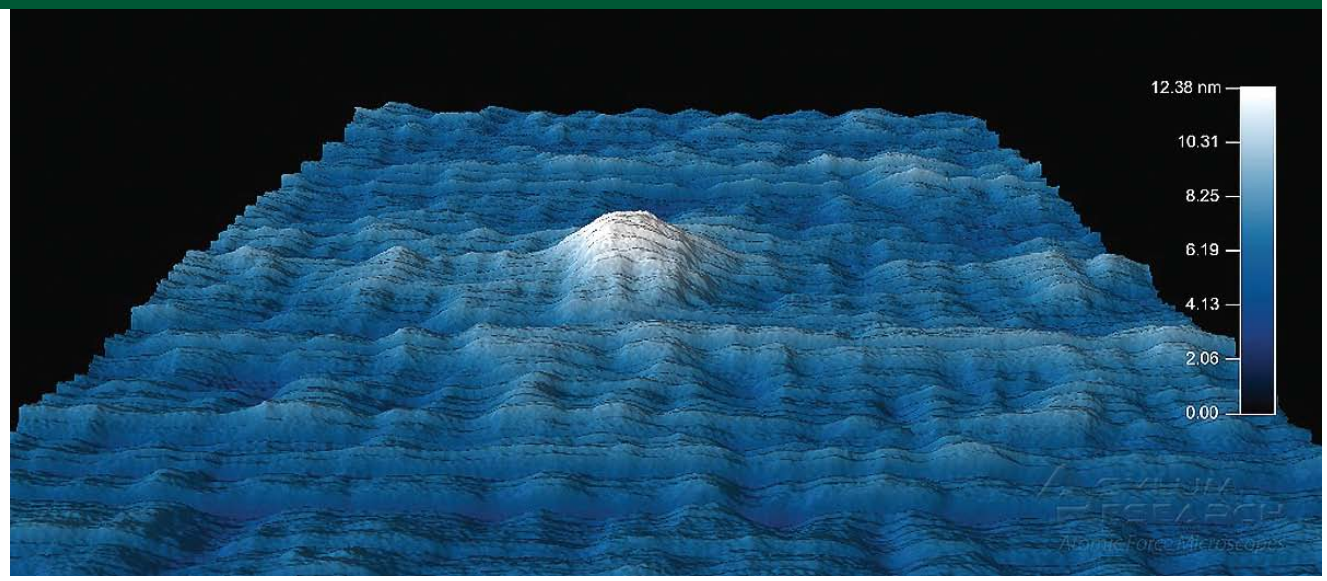
Countless engineers and scientists around the world are seeking new ways to produce energy without the use of fossil fuels. Cal Poly materials engineering master's student **Dan Marrujo** believes one solution may come in the form of quantum dots.

Marrujo, who also holds a degree in electrical engineering from Cal Poly, partnered with Raytheon to identify a means of improving the efficiency of photovoltaic cells found on solar panels. Raytheon took great interest in the project, but allowed a wide degree of latitude for Marrujo to investigate possible solutions.

Modern solar panels are notoriously inefficient, largely because they are restricted to converting a very narrow range of light – the visible spectrum. Marrujo sought to expand this range of energy conversion to ultraviolet and blue light.

He incorporated a thin film of quantum dots, or tiny nanoparticles, suspended in microfluidic channels. As light passes through these channels, the quantum dots convert high-energy ultraviolet light to a lower energy which can be used by traditional solar cells. Marrujo's research demonstrated that this technology greatly improves the overall efficiency of solar panels.

"This project reflects exactly what we want out of the PBLI process," said project advisor Dr. **Richard Savage**. "Companies like Raytheon receive the benefit of exposure to this cutting edge research, while PBLI enables us to offer students more opportunities for interaction with industry on multidisciplinary projects."



Reducing emissions at the road level

Three Cal Poly civil and environmental engineering students have taken a unique approach to reducing the greenhouse gas emissions of automobiles. Instead of looking at the vehicles themselves, they examined the traffic flow of roads which can lead to wasteful and inefficient use of fuel.

The students partnered with Fehr & Peers (F&P), a national consulting firm specializing in transportation planning and traffic engineering services. They researched variations of the traffic flow in Grover Beach, CA to determine how they could best reduce emissions.

Roadway planners classify traffic patterns by the amount of congestion, using a scale called Level of Service, or LOS, from A – F. LOS A is the least congested rating, while LOS F is the most congested. The students modeled changes to Grover Beach's roadways and intersections using LOS A – F and calculated the resulting emissions. They ultimately determined the most efficient operating point to be LOS C.

"Projects like this benefit industry by providing bright, fresh and energetic minds to work on problems that companies like Fehr & Peers don't have time to work on themselves," said one of the project advisors, Dr. **Ed Sullivan**.

F&P also used the project as a recruiting opportunity, hiring team co-leader **Rafael Cobian** after graduation. "I definitely plan to implement the findings of our research," he said. "I am very interested in the causes of greenhouse gas emissions, of which vehicles and traffic are major contributors."

Identifying friends and foe for ViaSat

The College of Engineering has joined ViaSat and PBLI in a project researching and expanding radio frequency signal

"This project reflects exactly what we want out of the PBLI process. Companies like Raytheon receive the benefit of exposure to this cutting edge research, while PBLI enables us to offer students more opportunities for interaction with industry on multidisciplinary projects."

Dr. Richard Savage — Quantum dots project adviser
Sponsor: **Raytheon**

TRAFFIC STUDY: Dr. Ed Sullivan, left, and Rafael Cobian (CE/ENVE), City and Regional planning professor Corne lius Nuworsoo, Tony Henderson (CE/ENVE) and CE/ENVE professor Sudeshna Mitra studied the traffic flow of roads which can lead to waste ful and inefficient use of fuel. The students partnered with Fehr & Peers (F&P), a national consulting firm specializing in transportation planning.

simulations.

Electrical engineering assistant professor Dr. **Dennis Derickson** and EE majors **James Wu** and **Ivan Bland** have been working with ViaSat's San Diego-based operations since late January on a subset of Identification Friend-or-Foe (IFF) systems using Field Programmable Gate Array (FPGA) boards.

IFF systems are digital analog hardware systems allowing air and sea crafts to create, interpret and dispatch complicated signals. "We're making a part of that signal environment," Derickson said, "the part that receives these identifying information signals and decodes them in a flexible manner. This will enable ships and aircrafts to send a signal of one format, configure their hardware to receive that format and send information out. And separately, if they want to change the signal format, we can make that possible with a simple hardware change."

"ViaSat values our graduates," notes Derickson. "This is a project that they thought would be a mutually beneficial."

Tackling Northrop Grumman's huge inventory of components

As one of the world's leading defense companies, Northrop Grumman Corporation (NGC) has a massive inventory of complex products that constantly cycle through the assembly process. The company contacted PBLI with an interest in deploying radio frequency identification (RFID) technology to track products and components as well as work-in-progress at its large Salt Lake City manufacturing facility.

After seeing Cal Poly's high-tech laboratory for Global Automatic Identification Technologies, PolyGAIT, and discussing the project with PolyGAIT director, **Dr. Tali Freed**, NGC executives Dr. **Charles Volk** and **Bob Bigley** were convinced that by utilizing Cal Poly's resources and students to design an RFID system, their company would save time and money.

"This project was particularly complex," said Freed. "No commercial RFID companies offer the capability of tracking electronic work-in-progress. Executing this correctly required prior knowledge; process expertise, which the student researchers acquired through summer internships; and PolyGAIT's state-of-the-art RFID lab infrastructure."

After presenting the prototype system, the Cal Poly project team received approval from production staff and executives alike and NGC is on its way towards implementing the system. ■

"Projects like this benefit industry by providing bright, fresh and energetic minds to work on problems that companies like Fehr & Peers don't have time to work on themselves."

Dr. Ed Sullivan — Traffic flow study advisor
Sponsor: **Fehr & Peers (F&P)**

RFID PROJECT: Dr. Tali Freed and IME student Max Peak worked with Northrop Grumman in deploying radio frequency identification (RFID) technology to track products and components in the company's vast ware houses.

2007-08 Sponsored Research

Sponsored faculty projects:

College of Engineering

■ **Summer Internships in Robotics:** Dr. **Mohammad Noori**, dean, and College of Engineering Research Scholar Dr. **George Bekey** received funding from the National Science Foundation to establish a three-year research internship program that helps ready students for employment in robotics. At least 60% of the students are recruited from under represented minorities or women.

Multidisciplinary

■ **Access by Design: Capstone Projects to Promote Adapted Physical Activity:** An NSF grant will boost the highly successful Adapted Activity Program, a joint program of the College of Engineering and Cal Poly's Kinesiology Department. Working in collaboration with the Central Coast Assistive Technology Center, a non-profit organization that works directly with clients who have physical and sensory disabilities, students will undertake team-based capstone projects that address the special exercise needs of persons with disabilities.

Aerospace Engineering

■ **Multidisciplinary Flight Control Techniques for the Simulation of Intelligent Unmanned Autonomous Vehicles:** Dr. **Dan Biezad** will complete a comprehensive system identification of unmanned aerial vehicles.

■ **Integrated Modeling and Verification of Hybrid Wing-Body, Low Noise ESTOL Aircraft:** NASA-Langley Research Center awarded Dr. **David Marshall** a multi-year, $900,000 grant to develop a modern, integrated aerodynamic/propulsion/structural/control tool for testing short takeoff and landing (STOL) performance in civilian and military aircraft.

■ **A multidisciplinary geometry based framework connecting design, optimization, aerodynamics, and structures:** Dr. **Rob McDonald** is developing a multidisciplinary analysis and optimization (MDAO) software framework that will facilitate the design of future aircraft. He was awarded a three-year NASA contract worth nearly $1 million.

Biomedical and General Engineering

■ **Survey of BioMEMS Systems:** Epson funded Dr. **David Clague** to survey BioMEMs systems and detail areas that are of common interest, such as biomarkers in sweat, microfluidic pumping technologies, packaging–interfacing between the micro & nano worlds with the macro-world, and advanced bio-separations for sample preparation.

■ **Biomechanical Comparison of Wire Circlage and Rigid Plate Fixation for Median Sternotomy Closure:** Dr. **Lanny Griffin** will advise Biomet Microfixation on comparative evaluations of cadaveric

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PBLI: The place for projects

A sampling of student projects from 2007-08:

Project Based Learning Institute

HILL-CLIMBING ROBOT — The "Hexor," a six-legged autonomous hill-climbing robot was the subject of a project by ME students Garran Gossage, Matthew Penny and Kevin Sill. The objective of the project was to allow the already exhisting robot to climb slopes.

ELECTRIC VEHICLE CONVERSION — ME students Ryan Nikkel, Chuck Althausen, Demetri Pettas and Nick Fernandez (not pictured) worked with Paul Bonderson, above right, to convert a gasoline-powered off-road vehicle to electric power.

"It was great working with Paul Bonderson; he was very helpful and we never had a problem with funding. The team was a great group of guys—our interest in the project lay in motorsports in general. The highlight? The minute we turned the key, it worked!"

Demitri Pettas — Mechanical Engineering Electric Vehicle Conversion Project
Sponsor: **Paul Bonderson**

SOLAR PANEL MOUNTING SYSTEM — Without employing the traditional nuts and bolt, Christopher Thode, Eric Melgares and Jared McClintock worked on a new system of mounting solar panels that cuts down on time and cost. The project was sponsored by Crown Renewable Energy.

"PROJEKT TURMUHR" — CENG students Steffan Hausler, Eric Roesler and Jared Walton worked with the Deutsches Museum on a demonstration project that showed how modern computer technology can be used for historical documentation, expansion of exhibits, and enhancement of exhibit aesthetics.

SOLAR POWERED BREWING — Will Seymour and Oliver Haya developed solar-powered microbrewery technology in conjunction with Dr. Zauner of Hochshule Munchen-Fakultat Maschinenbau.

"EARTH ORGAN" — Sergio Alberto Meza, Erik Scott Rutherford, Daniel Forest Tedrow and Andrew Victor Tranovich used infared sensors that respond to hand movements to develop an "earth organ" music exhibit for the San Luis Obispo Children's Museum.

"It was great working with the clients at VTC. They gave us hugs and stuff."

Joshua Jed Fadriguella —
BME Portable Enclosed Washbox

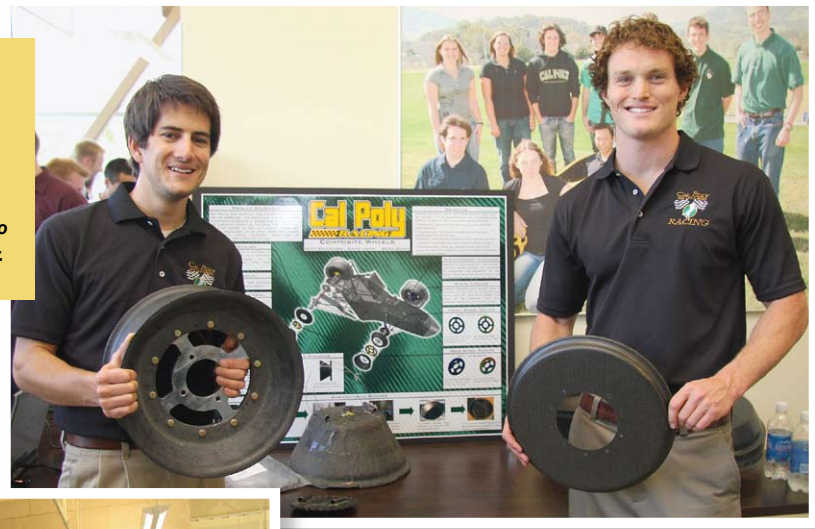
SUPERMILEAGE CAR FRONT END — ME students Alex Olaguez, Mark Holeman and Nathan Lattyak redesigned the front end suspension on the Cal Poly Supermileage car that won the Shell Eco-Challenge competition in 2007 with 1902.7 miles per gallon.

ADAPTIVE SIT SKI — *From upper left, ME professor Brian Self and ME students Tony Guntermann, Todd Maki and Keith Ohara worked on a Adapted Cross Country Sit Ski for paraplegic skiers. The project was sponsored by the U.S. Ski Team and Adapt-X.*

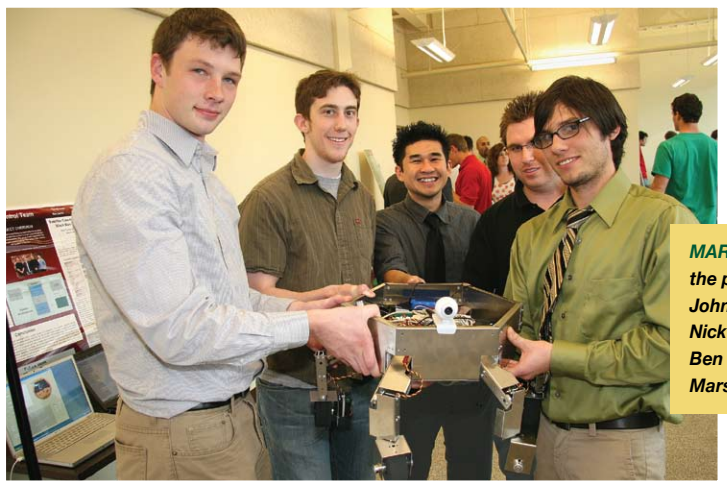
"For the last 18 weeks, we've been doing nothing else. Overall, we envisioned something with more features, but stuff happens. The project brought together everything I've learned, while also giving me the chance to learn from other majors. It helped me to be more multidisciplinary."

Audrey Steever — Mechanical Engineering Robotic Finger Spelling Hand for the Deaf-Blind
Sponsor: **Smith-Kettlewell Eye Research Institute**

CHAMPIONSHIP COMPOSITE WHEELS — *ME students Matt Callender, David Lowry and Brian Quinn developed new 13-inch composite wheels for Cal Poly's SAE Formula team. These new wheels needed to be light weight and strong enough to handle increased loads due to the aerodynamic components of the car.*



PHOTOS: LARRY COOLIDGE



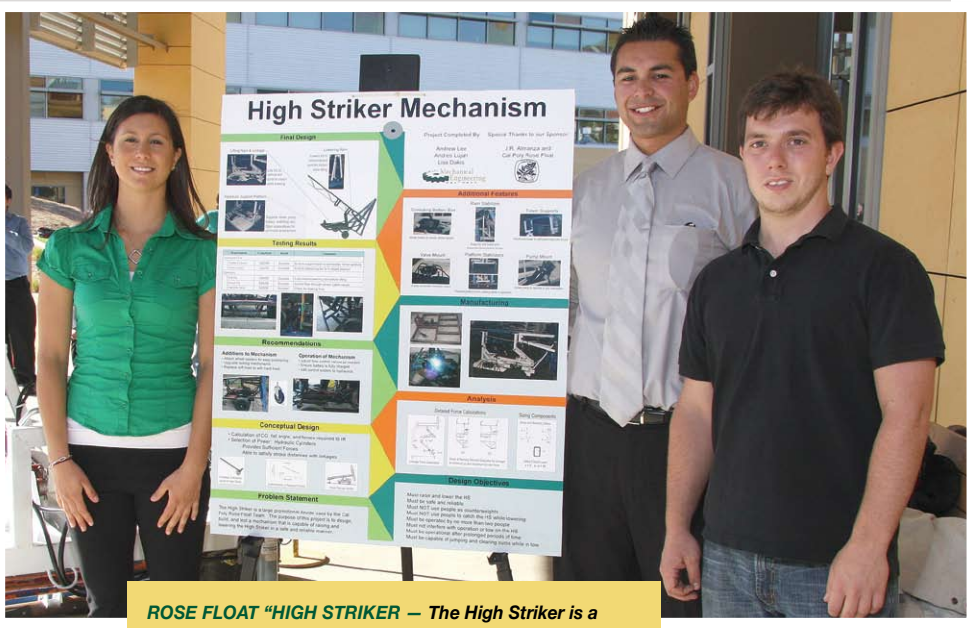
MARS ROBOT — *A miniture six-legged Mars Robot was the project of Computer Engineering students, from left: John Hoare, Ben St. Clair, Bao Duong, Coy Sanders and Nick Kubiak. Two other CPE students, Jose Angulo and Ben Davini, worked on a ground control system for the Mars Robot with professor Al Liddicoat.*

PORTABLE MASSAGE TABLE/CHAIR — *A new portable massage chair and table design that satisfies the needs of physical therapists was the result of international collaboration between CalPoly and the University of Applied Sciences Munich.*

"The difficult part was that the project was really open-ended. We realized that it would change, so we had to plan for expansion. This was the first time I worked for a real client—I learned firsthand that the budget was a constraint and that you need good input from your client."

Rohen Petterson — Computer Engineering Excavator Pod Project
Sponsor: **SLO Children's Museum**

ROCKET TRAILER — *ME students Jesse Rond, Pedro Castellanos and Joseph Uhlich developed rocket launcher trailer designed to test hybrid rocket technology. Their solution, a 20-foot-long rail built on a donated boat trailer that can launch a 1,000-pound rocket, came in under it's $4,800 budget.*



ROSE FLOAT "HIGH STRIKER — *The High Striker is a large promotional device used by the Cal Poly Rose Float Team. Mechanical engineering students Lisa Dakis, Andrew Lee and Andres Lujan worked to design, build, and test a mechanism that is capable of raising and lowering the High Striker in a safe and reliable manner. The project was sponsored by J.R. Almanza and Cal Poly Rose Float.*

2006-07 Sponsored Projects

sterna fixation via simulated mechanical loading.

■ **Long Term Effects of Bisphosphonate Therapy on Bone:** The National Institutes of Health provided funding for Dr. **Scott Hazelwood** to investigate the effects of bisphosphonate treatment on postmenopausal osteoporosis.

Civil & Environmental Engineering

■ **Water Jetting of CIDH Pile Anomalies:** Research by Dr. **Gregg Fiegel** should lead to a "standardized" water jetting repair technique for Caltrans bridge foundations, especially cast-in-drilled-hole (CIDH) piles.

■ **Enhanced Interpolation Schemes for Accurate Estimation of Engineering Demand Parameters from Recorded Strong-Motion Data of Buildings:** Dr. **Rakesh Goel**'s research will enhance the CA Dept. of Conservation's ability to evaluate and improve current analytical procedures for seismic evaluation of building structures.

■ **USUCGER Workshop 2008:** NSF provided funding to Dr. **James Hanson** to organize a United States Universities Council on Geotechnical Education and Research workshop.

■ **Swimming Pool Research:** Dr. **Damian Kachlakev** is working on multiple projects regarding the surface and etching deterioration of plastered swimming pools under grants from the National Plasterers Council.

■ **Testing Boron Precipitation at the Arroyo Grande Oil Field:** This project by Dr. **Tryg Lundquist** responds to the need to develop a method to remove boron from produced waters at the Arroyo Grande (AG) Oil Field.

■ **Wastewater Facility Project:** Dr. **Tryg Lundquist** is teaming with Sustainable Conservation, Inc. a non-profit organization with funding from the Environmental Protection Agency, to construct a novel demonstration facility for the treatment of dairy wastewaters.

■ **Enhancing Road Traffic Safety:** Under a seed-grant, Dr. **Sudeshna Mitra** will analyze the high crash statistics in the Inland Empire and develop methodologies to identify areas for safety improvements.

■ **Phytoremediation and bioremediation of the Guadalupe Oil Field:** Chevron continues to support Dr. **Yarrow Nelson** and graduate students in their research on environmental remediation at the Guadalupe Sand Dunes.

Computer Science

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

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Waste treatment and biofuels projects receive state funding

CE/ENVE grad student Dan Frost operated a wastewater treatment and algae production pilot plant for his thesis research. Other students analyzed his algae for its biofuel potential.

THE NEED FOR ENERGY CONSERvation and new sources of fuel has lead to new funding for students and faculty in the Civil and Environmental Engineering Department. Graduate and undergraduate students of Drs. **Tryg Lundquist** and **Yarrow Nelson** have undertaken various research projects with topics such as the production of biofuel feedstock and treatment of oil well wastewater.

Lundquist and Nelson, along with **Corinne Lehr** (Chemistry) and **Chris Kitts** (Microbiology) have received funds from the California Central Coast Research Partnership (C3RP) to continue development of an energy-conserving wastewater treatment process which also produces algae biomass, a biofuel feedstock. Dr. Lehr and her students are investigating the content and quality of oil in the algae, and Dr. Kitts will quantify the important microbes contributing to treatment in the algae pilot plant. Other wastewater grants coming to the Civil and Environmental Engineering Department include a grant from the U.S. Environmental Protection Agency to construct and study a pilot biofilm reactor for nitrogen removal from dairy wastewater, and a grant from BP (British Petroleum) through the UC Berkeley Energy Biosciences Institute for a techno-economic assessment of algae biofuels, which addresses the numerous economic and physical constraints on large-scale algae production.

"There's this opportunity opening, a gap that needs to be filled, which is to develop inexpensive ways to treat wastewater on farms. That's the role of the dairy biofilm reactor," Lundquist said. The technology (invented at the Tennessee Valley Authority) has worked well for swine and human wastewater, but the Cal Poly project will be the first time it is used on dairy wastewater. The reactor should use far less electricity than alternative technologies.

On the more traditional fuel side, Lundquist and Nelson are heading a project aimed to treat "produced water," which comes from oil wells. "Oil fields that used to be uneconomical, due to the high cost of produced water treatment, are now coming into production. We are working on developing techniques to remove difficult pollutants from these waters," Lundquist said.

Lundquist says that all of these projects are long-term efforts. "We are continuing to strengthen our capabilities with these grants—training more students, developing techniques and experience. The projects also feed equipment and real-world problems into the classrooms."

And the problems are ones that will have to be tackled by Cal Poly graduates. "Those projects are important now and they're going to continue to be important in the future," Lundquist said. "We've got a growing population, the water supply is not growing, fuel supplies are not necessarily growing, so water and energy are areas where there's always going to be a lot of work." ■

"We are continuing to strengthen our capabilities with these grants—training more students, developing techniques and experience. The projects also feed equipment and real-world problems into the classrooms."

Tryg Lundquist — CE/ENVE professor
Funding: **California Central Coast Research Partnership**

Project focuses on improving communication technologies on Red Cross disaster relief trailer

CAL POLY ELECTRICAL ENGINEERING ALUM **JIM MEDEIROS** developed a unique opportunity for College of Engineering students to partner with the American Red Cross.

The project aimed to improve mobile disaster communications and electrical systems for a Red Cross remote communications center, which belongs to the Carmel Red Cross Chapter and is available to San Luis Obispo County if needed.

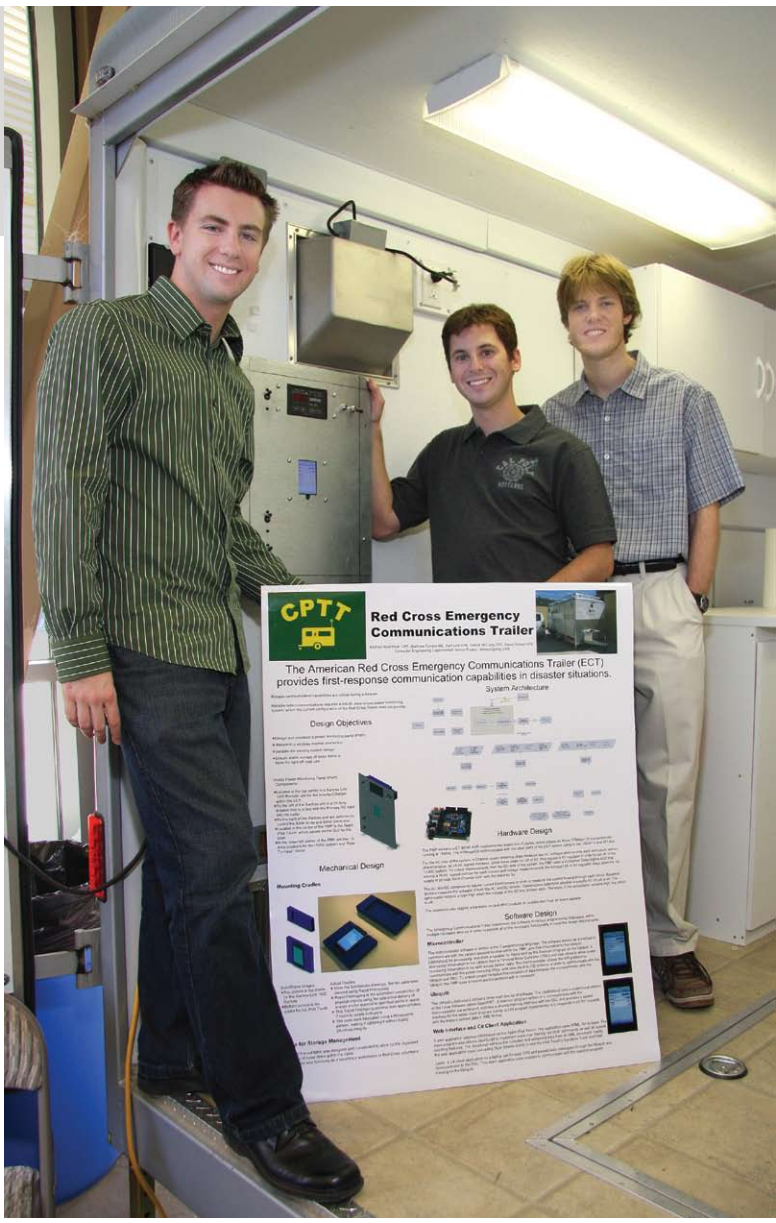
"This was a great opportunity for students to do creative thinking."

Jim Medeiros — CE/ENVE alum
Sponsor: **American Red Cross, Carmel chapter**

"This was a great opportunity for students to do creative thinking," said Medeiros. "We wanted the systems on this communication center to be state of the art, ergonomic and user-friendly, making it readily usable for non-technical volunteers in a time of emergency."

Medeiros said the project required the expertise and unique perspectives of Cal Poly students from various backgrounds, including mechanical engineering, industrial engineering, electrical engineering, and computer engineering.

The remote communications center is a mobile mini-headquarters designed for use during an emergency, such as the recent Paso Robles earthquake. It is equipped with radio communications systems and can generate its own power supply via solar and wind power. The project utilized the open space and modern equipment provided by the Bonderson Projects Center on the Cal Poly campus, where the trailer is currently parked. "It will encourage students to apply their skills in a different way, to help their community," said Medeiros, who is a member of Cal Poly's Computer Engineering Industrial Advisory Board and a long-time Red Cross volunteer. ■



Team Tech partners with Stryker to create next-generation surgical device

THE CAL POLY SOCIETY OF WOMEN ENGINEERS (SWE) IS redesigning a surgical system for Stryker Endoscopy, with plans to reduce surgery time and increase the ease of use for arthroscopic surgeons across the country. The multidisciplinary team is also working for a repeat performance, following Cal Poly SWE's first place finish last year at the national Team Tech Competition sponsored by Boeing.

"The general goal of engineering is to improve quality of life," said team leader **Claire Miller**, a business administration and bioresource and agricultural engineering senior. She and co-director **Katie Gage**, mechanical engineering junior, have a combined seven years of service and participation in SWE.

They were both members of last year's Team Tech, but the project this year is quite a departure from the winning design for a roller coaster weld inspection device. "We are excited to have undertaken a biomedical project because we have a brand new biomedical engineering department and many eager BMED students," they said, "Many other engineering students will find themselves working in this expanding industry as well."

The team's tissue resection system will be used for arthroscopic surgery, more commonly known as joint surgery. The biomedical industry is tightly regulated and the team deliberated carefully before implementing their plan.

"We've been exposed to aspects of the design process that engineering students are generally not concerned with during a project. Every team member is exposed to the entire design process — from conception to completion," said Miller.

"Every team member is exposed to the entire design process — from conception to completion"

Claire Miller — Team Tech project leader
Sponsor: **Boeing**

Stryker provided basic parameters and the students independently sought end-user feedback to more closely define the design requirements. Team Tech has produced working prototypes and the students are conducting industry-recommended tests to ensure proper performance.

Team Tech is comprised of students from nine disciplines, each bringing unique skill sets to the table. "Every member not only brings different ideas from their own major, but also from their individual engineering experience, applied backgrounds, and personal perspectives," said Miller, "These differences helped greatly to expand our design."

Students will put their design to the test at the national Team Tech competition, November 2008 in Baltimore, MD. Their project will be evaluated on the criteria of teamwork, use of engineering processes, the final product, quality of the results, and the ability to work side-by-side with industry. For more information on Cal Poly's SWE chapter, visit: http://www.csc.calpoly.edu/~swe/index.php ■

ME seniors' straightforward design wins NISH national award — and helps aspiring young workers with disabilities

MECHANICAL ENGINEERING SENIORS **PAULA GIJON** AND **Chittayong (Jao) Surakitbanharn** combined practicality and simplicity of design to create an award-winning device that makes life much easier for disabled hospitality industry employees.

The team's "Napkin Roll Assist" senior project won the NISH National Scholar Award, which recognizes the design of devices to improve access to the workplace for persons with disabilities. The students received a $10,000 prize for first place and earned a matching $10,000 grant for the Mechanical Engineering Department.

"We brainstormed all the different options – from complex fully-automated devices to simple and effective solutions," said Surakitbanharn. "After much thought and application of the engineering principles we have learned, we concluded that our user and sponsor's needs would best be met with a simple, low cost and easily manufactured device."

The final product consists of a two-step process for rolling napkins that can be easily completed using only one hand. Project sponsor VTC Enterprises has already made use of the napkin roller, which aids its vocational training of individuals with limited dexterity. VTC says it was impressed with the design and has ordered 10-20 additional napkin rollers.

ME professor James Widman, left, and ME students Paula Gijon, right, and Chittayong (Jao) Surakitbanharn demonstrate their Napkin Roll assist device which helps workers with limited dexterity. The device received a $10,000 NISH National Scholar Award.

"Our design was really simple, but this was intentional because we still wanted to provide the users with a meaningful job," explained Gijon.

The "Napkin Roll Assist" was just one of several senior projects that Cal Poly students created for VTC during the 2007-08 academic year. The Santa Maria, CA based non-profit puts more than 250 people with special needs to work for companies throughout the Central Coast.

NISH founded the National Scholar Award for Workplace Innovation & Design to encourage the development of creative technological solutions for barriers that prevent people with disabilities from entering or advancing in the workplace. The National Scholar Award program is an excellent service learning opportunity for engineering, computer science, industrial design, physical therapy and occupational therapy students. ■

"After much thought and application of the engineering principles we have learned, we concluded that our user and sponsor's needs would best be met with a simple, low cost and easily manufactured device."

Chittayong (Jao) Surakitbanharn — ME senior
Sponsor: **VTC Enterprises**

2005-06 Sponsored Projects

Electrical Engineering

■ **Student Laser Project:** The goal of this project sponsored by JDS Uniphase Corporation and directed by Dr. **Dennis Derickson** is to have students explore non-telecommunication applications of a new class of laser.

■ **Efficient Deployment of Advanced Public Transportation Systems (EDAPTS) Project Support:** This project undertaken in collaboration with the California Center for Innovative Transportation will help the commercialization of the EDAPTS transit management system developed at Cal Poly in partnership with Caltrans.

■ **Modeling of Semiconductor Lasers and Photodiodes:** Agilent has sponsored research by Dr. **Xiaomin Jin** and Cal Poly graduate students on semiconductor lasers, photodiodes, and cables for interferometer measurement system applications. This research will help design a new platform for the electronics of laser interferometer position measurement systems.

■ **Digital Filtering and Signal Recognition:** Sonic Sensors sponsored a student project to investigate alternative digital signal processing techniques.

■ **Synthetic Aperture Radar Automatic Target Recognition for Ground Targets:** Since 2004, Raytheon has funded work by Dr. **John Saghri** to develop Synthetic Aperture Radar Automatic Target Recognition (SAR ATR) for Ground Targets technology.

Industrial & Manufacturing Engineering

■ **Warehouse RFID Project:** Under the direction of Dr. **Tali Freed**, a team of Cal Poly students and faculty will implement 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.

■ **Advanced Thermosonic Gold Wirebonding:** Teledyne Electronic Technologies sponsored research by Dr. **Jianbiao Pan** on coping with advanced wirebonding requirements by bonding the thermosonic Au wires with higher frequency (100 – 120 KHz) ultrasonic energy.

■ **Competitive Carbide Cutting Tools:** Dr. **Dan Waldorf** was awarded an NSF Small Business Innovation Research (SBIR) Phase I project as a subcontractor to Genius Metal Inc. The work will develop wear resistant metal-matrix composite materials.

Materials Engineering

■ **Civil and Environmental Engineering Education Transformational Change:** A collaborative effort with Yale and Michigan Tech and sponsored by the National Science Foundation, this project by Dr. **Linda Vanasupa** aims to transform civil and environmental engineering education to support the increased attention on global sustainability.

Continued on Page 8

2005-06 Sponsored Projects

Mechanical Engineering

■ **Sensor Integration for Low-Cost Crash Avoidance:** By including different sensors in a system with an integration algorithm, researcher Dr. **Charles Birdsong** hopes to develop a cost-efficient crash avoidance technology to improve truck safety. The project is sponsored by the Transportation Research Board.

■ **Annular Aerospike Nozzle Research:** Drs. **Thomas Carpenter** and **William Murray** have teamed with Rolling Hills Research under NASA Small Business Technology Transfer (STTR) proposals to develop annular aerospike nozzles.

■ **Portable Electric Spa Stand-by Energy Test Protocol:** The National Plasterers Council sponsored Dr. **Andrew Kean** to measure the energy consumption of a portable electric spa.

■ **Model of Cartilage Growth Biomechanics:** Dr. **Stephen Klisch** continues to develop methods for the repair of cartilage defects under a grant from the National Institutes of Health.

■ **Improving Engineering Students' Learning Strategies through Models and Modeling:** Dr. **Brian Self** is working with colleagues from the University of Pittsburgh and other institutions on a $2 million NSF project to improve engineering education and nurture student ethics.

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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career paths. Of course, the benefits cut both ways: PBLI and our project-based educational environment enrich recruitment opportunities for industry representatives, who get a preview of excellent candidates for employment.

Do you see Cal Poly as a leader in a growing movement among engineering schools, even those that have traditionally focused more on theory, to emphasize projects in their curricula?

At Cal Poly Engineering, we recognize that engineers have a special responsibility to address our global challenges—challenges that offer enormous engineering opportunities. Our vision, therefore, is to leverage project-based learning to foster innovation and to educate a new type of engineer, one with social awareness. A driving force in our curriculum, in fact, is social connectivity.

In addition, whereas other schools offer project-based learning, 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.

How can companies without particular project needs become active in working with and supporting CENG?

All engineering companies recognize that the country is facing a crisis. We have a pipeline problem, a workforce shortage, and a great need to diversify engineering.

We invite companies to team with Cal Poly Engineering on our efforts to address this crisis through outreach and recruiting activities, like our Engineering Days Summer Camp, which brought almost 100 middle and high school students to campus for a week of engineering excitement. Without support from industry and private resources, we won't be able to expand these highly effective recruitment programs.

Today's engineers have a "special responsibility" to address the needs of their communities, and Project Based Learning Institute efforts can meet the engineering needs of non-profit and community organizations says College of Engineering Dean Mohammad Noori.

In addition, companies can help us provide scholarships to highly qualified and needy students, offer support to faculty who are developing new and innovative programs that address specific needs of industry, create summer internships for our students and in-industry faculty sabbatical leave opportunities . . . the possibilities for partnership are endless and depend entirely on the needs and goals of individual companies.

In short, while the College of Engineering has been very successful (after all, we're the nation's top public, non-doctoral engineering school) California State budget cuts threaten our continued success. We need private companies and industry partners to step up. By investing in Cal Poly Engineering, they are investing in their own—and everyone's—future.

Can you remember a project you worked on as an undergraduate in engineering?

Engineering education in the early '70s did not include the notion of teamwork or capstone projects. Yet, even then, the idea of working on real world projects was so exciting. I was fortunate to work with Dr. William Hall at the University of Illinois at Urbana. He is one of the legendary leaders in structural steel design and a chief architect of the Alaskan Oil Pipeline, a monumental project, as you might know. A class assignment was a component of the Pipeline foundation system, a complex structure to begin with and made more difficult by the harsh environment of Alaska. It took me months to complete the assignment; but to this day, I remember and am grateful for the challenge Dr. Hall entrusted in me. He was truly an outstanding mentor and a legendary engineer. ■

Help us bring real-world problems to Cal Poly engineering students!

YES!

I am interested! Please contact me by:

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