

THIRTY-NINTH ANNUAL PROJECTS DAY

The Computer Science, Engineering, Mathematics, Physics and Global Clinics of Harvey Mudd College are pleased to present the work of our students.

Robert Keller, Director
Computer Science Clinic

Patrick Little, Director
Engineering Clinic

Alfonso Castro, Director
Mathematics Clinic

Richard Haskell, Director
Physics Clinic

Shenda Baker, Director
Global Clinic

HARVEY MUDD COLLEGE
PROJECTS DAY
May 5, 2009

Program

10:30 a.m.	Registration and Poster Viewing	Linde Activities Center
1:00 p.m.	General Session	Galileo/McAlister
	Welcome - Maria Klawe, President	
	Remarks - Richard Haskell, Director Physics Clinic	
	Milestone Awards - Robert J. Cave, Vice President and Dean of the Faculty	
	Recipients: QUALCOMM Corporation Southwest Research Institute	
1:30 - 3:00 p.m.	Project Presentations	See Map (center page)
3:00 - 3:30 p.m.	Break	Hixon Court
3:30 - 5:00 p.m.	Project Presentations	See Map (center page)
5:15 - 6:00 p.m.	Poster Reception for Guests, Faculty, and Students	Linde Activities Center

Schedule of Presentations

Project	Time						Location
	1:30	2:00	2:30	3:30	4:00	4:30	
COMPUTER SCIENCE CLINIC							
FICO (Fair Isaac Corporation) <i>Automatic Collaboration Enhancement</i>	X		X		X		B-B126
Fox Interactive Media-MySpace <i>MySpace Music Recommendation System</i>	X		X		X		Edwards
Genius.com Inc. <i>Auto-Detecting Third-Party Generated Events for Real-Time Personal Website Analytics</i>	X		X		X		B-B105
LinkedIn Corporation <i>Building A Replicated Transaction Log Library</i>	X		X		X		J-B134
magnify360 <i>Maximizing Yield in the Shopping Cart by Predictive Modeling of Individual User Behavior</i>		X		X		X	Edwards
The Platform for Media <i>Building a Domain-Specific Language for Media Publishing</i>		X		X		X	J-B134
QUALCOMM <i>Management Data Repository for Open Source Network Management</i>		X		X		X	B-B126
COMPUTER SCIENCE/ MATHEMATICS CLINIC							
Community of Ordinary Differential Equations Educators (CODEE) <i>ODE Toolkit: Deployment of Software to Aid the Teaching and Learning of Ordinary Differential Equations</i>		X		X		X	B-B105

Building Codes:

B = Beckman

J = Jacobs

P = Parsons

Edwards = Galileo-Edwards

McAlister = Galileo-McAlister

Pryne = Galileo-Pryne

Note: The “B” AFTER the hyphen in room numbers indicates “Basement Level.”

Project	Time					Location
	1:30	2:00	2:30	3:30	4:00	
ENGINEERING CLINIC						
9:Fish Surfboards <i>Manufacturing Process for a Recyclable Surfboard</i>	X		X		X	McAlister
The Aerospace Corporation <i>Picosatellite Wireless Communication</i>	X		X		X	P-B181
AeroVironment, Inc. <i>Increased Covertness of Small Unmanned Aerial Vehicles</i>	X		X		X	P1285
Cardinal Health <i>Respiration Sensing</i>		X		X		X P1283
Center for Integration of Medicine and Innovative Technology - CIMIT <i>Design and Development of an Integrated Clinical Environment Supervisor (ICES) for Trauma Care</i>	X		X		X	P1277
Cobham; Sargent Fletcher Inc. <i>Design of Test Firing Apparatus for Pneumatic Ejection Racks</i>	X		X		X	P2379
DirecTV Inc. <i>Aiding the Satellite Dish Installation Process</i>	X		X		X	P2383
Honeywell Aerospace <i>Aerospace-Grade Induction Motor Tester</i>		X		X		X P-B181
Intel Corporation <i>CMOS Public-Key Cryptography Accelerators</i>		X		X		X P2383
Los Alamos National Laboratory <i>Development of a Diagnostic Wire Scanner for a Linear Particle Accelerator</i>	X		X		X	P1287C
National Optical Astronomy Observatory (NOAO) <i>Ultra-Low Noise Digital Readout System for a CCD Telescope</i>	X		X		X	P1283
Nike, Inc. <i>In-Store Assembly and Customization of Footwear</i>		X		X		X McAlister
Nike, Inc. <i>Design of Cleatless Soccer Shoes</i>	X		X		X	P1275
Northrop Grumman Corporation <i>Point to Point Wireless Communication Interface to Test Navigation Systems</i>		X		X		X P1275
Oregon Biomedical Engineering Institute (OBEI) <i>Advanced Hemostatic Agent Delivery Device (AHADD)</i>	X		X		X	P1264
Oregon Biomedical Engineering Institute (OBEI) <i>Automated Nanofiber Vascular Fabrication Device</i>		X		X		X P1264
Orthodyne Electronics <i>Modeling the Viscoelastic Behavior of Vibration Isolation Mounts for an Ultrasonic Wire Bonder</i>	X		X		X	P2358
Southwest Research Institute (SwRI) <i>Time-of-Flight Measurements Using FPGAs</i>		X		X		X P1287C
Space Systems/Loral <i>Modeling Shock Attenuation in Spacecraft Panels</i>		X		X		X P1285

Project	Time						Location
	1:30	2:00	2:30	3:30	4:00	4:30	
SRI International <i>Development of Barometric Altimetry System for Personnel Tracking</i>		X		X		X	P2358
Three Valleys Municipal Water District <i>Use of Alternative Energy Sources at Three Valleys Municipal Water District</i>		X		X		X	P2379
TREX Enterprises Corporation <i>In-Building Tracking of Emergency Rescue Personnel</i>		X		X		X	P1277
GLOBAL CLINIC							
Applied Biosystems <i>Low Cost Real-Time Polymerase Chain Reaction Instrument for Educational Market</i>	X		X		X		J-B132
Lien Institute for the Environment <i>Design of a Household Level Arsenic Treatment System for Rural Cambodia</i>		X		X		X	J-B132
KGI/ENGINEERING CLINIC							
Syngenta <i>Automated Design for Single Seed Handling</i>		X		X		X	P-B183
MATHEMATICS CLINIC							
Chicago Trading Company <i>Building a Multi-Agent Artificial Stock Market</i>		X		X		X	Pryne
Citadel Investment Group <i>Optimizing Pairs Trading Portfolios</i>	X		X		X		B-B134
Laserfiche <i>Deblurring: Removing Image Distortion Induced by Camera Motion</i>		X		X		X	B-B134
PHYSICS/ENGINEERING CLINIC							
Lawrence Livermore National Laboratory <i>Calibration Source for a Prototype Car-Wash Detector of Fissile Material</i>	X		X		X		P-B183
PHYSICS/MATHEMATICS CLINIC							
Cardinal Health <i>Modeling Fluid Transport in Subcutaneous Tissue</i>	X		X		X		Pryne

2008/2009 Clinic Sponsors

Computer Science

FICO (Fair Isaac Corporation)
Fox Interactive Media-MySpace
Genius.com Inc.
LinkedIn Corporation
magnify360
The Platform for Media
QUALCOMM Incorporated

Computer Science/Mathematics

Community of Ordinary differential
Equations Educators (CODEE)

Engineering

9:Fish Surfboards
The Aerospace Corporation
AeroVironment, Inc.
Cardinal Health
Center for Integration of Medicine
and Innovative Technology
(CIMIT)
Cobham; Sargent Fletcher Inc.
DirecTV, Inc.
Honeywell Aerospace
Intel Corporation
Los Alamos National Laboratory
National Optical Astronomy
Observatory (NOAO)
Nike
Northrop Grumman Corporation
Oregon Biomedical Engineering
Institute (OBEI)
Orthodyne Electronics
Southwest Research Institute (SwRI)
Space Systems/Loral
SRI International
Three Valleys Municipal Water
District (TVMWD)
TRENK Enterprises Corporation

Global

Applied Biosystems Inc.
Lien Institute for the Environment

KGI/Engineering

Syngenta

Mathematics

Chicago Trading Company
Citadel Investment Group
Laserfiche

Physics/Engineering

Lawrence Livermore National
Laboratory

Physics/Mathematics

Cardinal Health

CLINIC ADVISORY COMMITTEE OF HARVEY MUDD COLLEGE BOARD OF TRUSTEES

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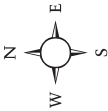
College Members:

Maria Klawe, *President*
Marc Archambault, *Vice President, College Advancement*
Robert J. Cave, *Vice President, Dean of the Faculty*
Andrew Dorantes, *VP for Admin & Fin/Treas.*
Erin Watkins, *Asst VP for Investment & Asst Treas.*
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Robert Keller, *Computer Science*
Patrick Little, *Engineering*
Alfonso Castro, *Mathematics*
Richard Haskell, *Physics*
Shenda Baker, *Chemistry*

Personalized Projects Day Schedule

Please fill in the empty slots below with the presentations you would like to attend.

Time	Event	Location
10:30 a.m.	Registration and Poster Viewing	Linde Activities Center
1:00 p.m.	General Session	Galileo/ McAlister
1:30 p.m.		
2:00 p.m.		
2:30 p.m.		
3:00 p.m. - 3:30 p.m.	Break	Hixon Court
3:30 p.m.		
4:00 p.m.		
4:30 p.m.		
5:00 p.m. - 6:00 p.m.	Poster Reception	Linde Activities Center



General Session 1:00 p.m.
Galileo Hall
Presentations 1:30 p.m. to 5:00 p.m.

Projects Day Campus Map

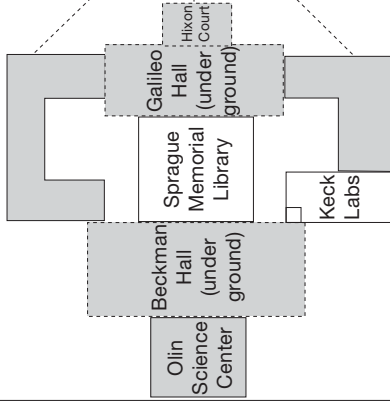
Registration & Poster Viewing for Projects Day
10:30 a.m. to 12:45 p.m.
Poster Reception
5:15 p.m. to 6:00 p.m.
Linde Activities Center

To 210 Fwy. ←
Towne Avenue
Indian Hill Boulevard
To 10 Fwy. →
Dartmouth Avenue
12th St. ←

Foothill Boulevard (Parking available on both sides of street)

Mills Avenue

Parsons Engineering Bldg.



Linde Activities Center

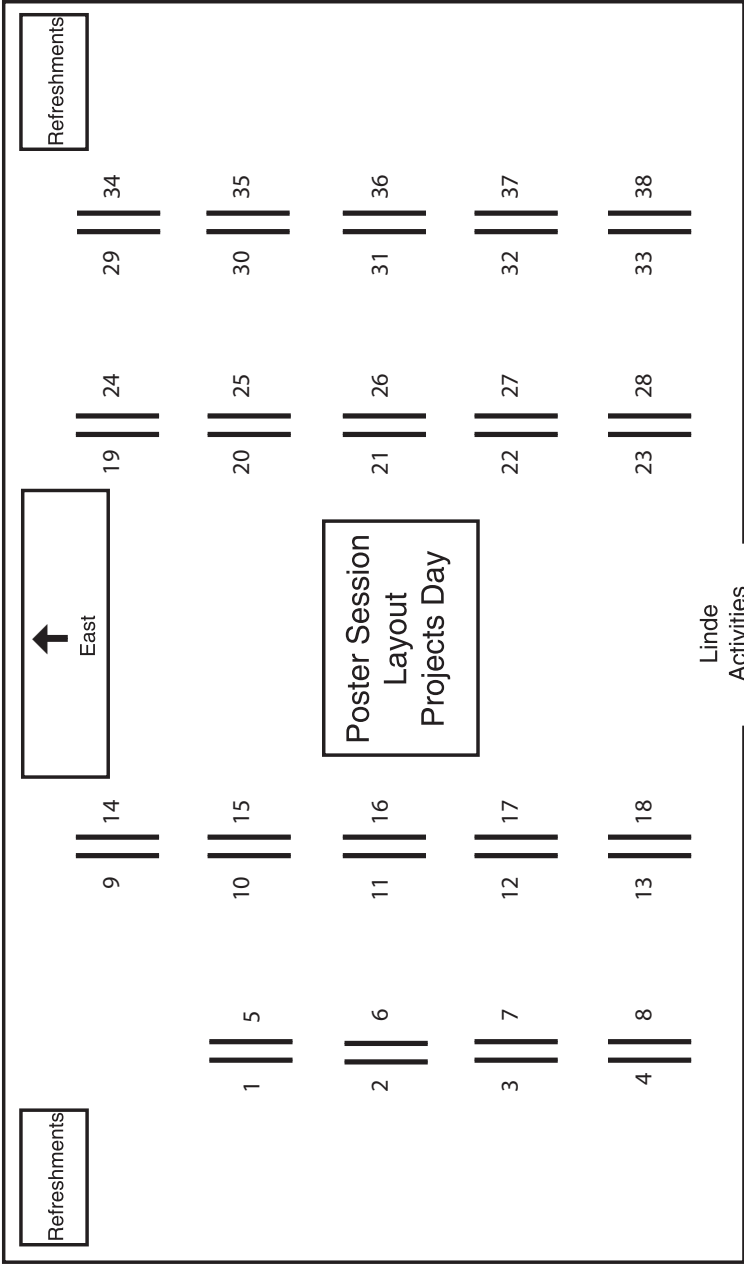
Platt Campus Center

Harvey Mudd College
(not to scale)

Kingston Hall

Hoch-Shanahan Dining Commons

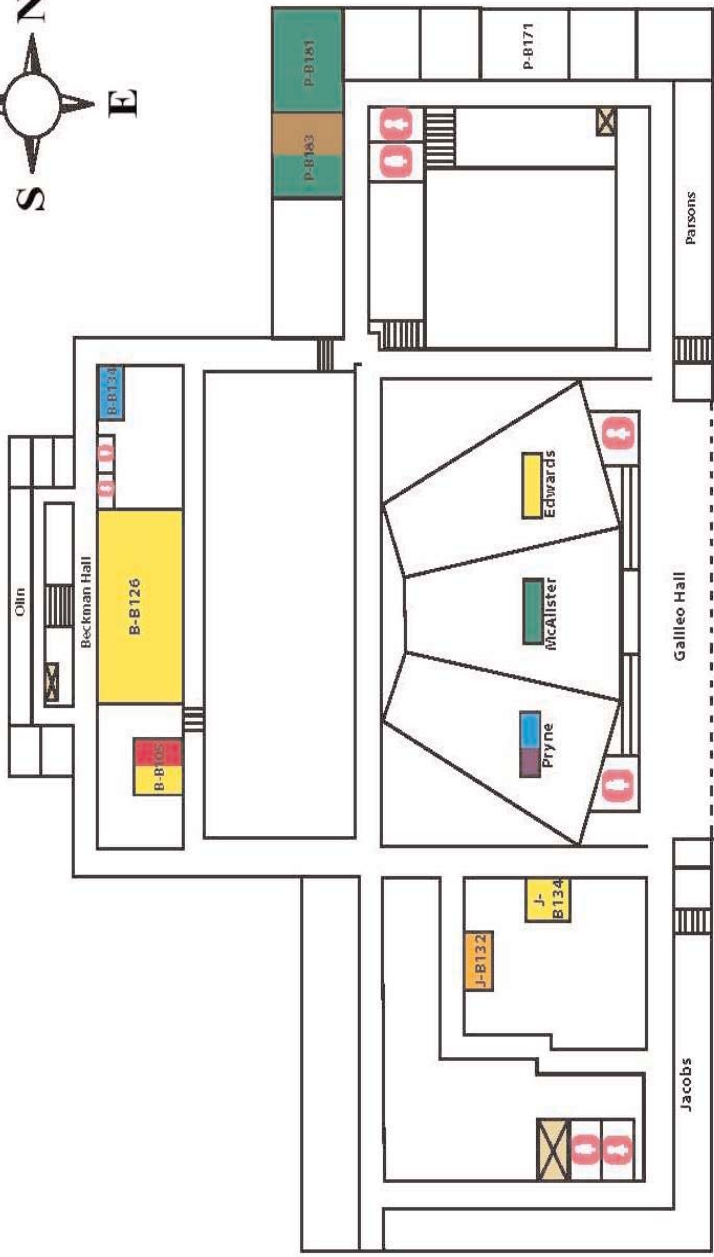
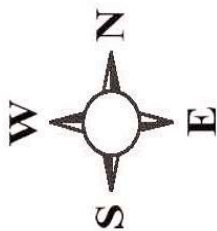
Garrett House



Key to Poster Session Layout

1. 9:Fish Surfboards
2. Applied Biosystems Inc.
3. The Aerospace Corporation
4. AeroVironment, Inc.
5. Cardinal Health - Engineering
6. Cardinal Health - Physics/Math
7. Center for Integration of Medicine and Innovative Technology (CIMIT)
8. Chicago Trading Company
9. Citadel Investment Group
10. Cobham; Sargent Fletcher Inc.
11. Community of Ordinary Differential Equations Educators (CODEE)
12. DirecTV, Inc.
13. FICO (Fair Isaac Corporation)
14. Fox Interactive Media-MySpace
15. Genius.com Inc.
16. Honeywell Aerospace
17. Intel Corporation
18. Laserfiche
19. Lawrence Livermore National Laboratory
20. Lien Institute for the Environment
21. LinkedIn Corporation
22. Los Alamos National Laboratory
23. magnify360
24. National Optical Astronomy Observatory (NOAO)*
25. Nike, Inc. - Cleat Free
26. Nike, Inc. - In-Store Project
27. Northrop Grumman Corporation
28. Oregon Biomedical Engineering Institute (OBEI) - AHADD
29. Oregon Biomedical Engineering Institute (OBEI) - Nano-Fiber
30. Orthodyne Electronics
31. The Platform for Media
32. QUALCOMM Incorporated
33. Southwest Research Institute (SwRI)
34. Space Systems/Loral
35. SRI International
36. Syngenta
37. Three Valleys Municipal Water District (TVMWD)
38. TREX Enterprises Corporation

*NOAO is operated by the Association of Universities for Research In Astronomy under a cooperative agreement with the National Science Foundation.



Basement Floor of Beckman, Galileo & Parsons



Legend

- Computer Science Clinic
- Computer Science/Math Clinic
- Engineering Clinic
- Global Clinic
- Mathematics Clinic
- Math/Physics Clinic
- Physics/Engineering Clinic
- ♂
♀ Restrooms
- ▤ Stairs
- ✕ Elevator

First and Second Floors of Parsons

COMPUTER SCIENCE CLINIC

FICO (Fair Isaac Corporation)

Automatic Collaboration Enhancement

Liaisons: Stuart Crawford, Chris Erickson, Deena Narayanaswamy, Eric Wells

Advisor: Melissa O'Neill

Students: Anton Bakalov, Martin Field, Kyle Marsh, Adrian Sampson (PM)

The team has prototyped an automated system for increasing collaboration in corporate environments. The system analyzes corporate email to discover opportunities for collaboration. Employees then receive recommendations to communicate with other, similarly-interested people. The project leverages machine learning, clustering, and text processing techniques.

Fox Interactive Media-MySpace

MySpace Music Recommendation System

Liaison: Arshavir Blackwell

Advisor: Z Sweedyk

Students: Hannah Hoersting, Heather Justice, Shaun Wallace (PM-F), Tyler Wolf (PM-S)

The MySpace social networking website allows members to create personal profiles and share them with other users. One significant feature of MySpace allows members to share their tastes in music and to listen to popular music. The goal of this project is to use this data to develop and assess a prototype music recommendation system for MySpace. We have created an application that reads a user's music preferences from their profile and recommends other artists the user may appreciate.

Genius.com Inc.

Auto-Detecting Third-Party Generated Events for Real-Time Personal Website Analytics

Liaison: Ryan Ausanka-Cruces

Advisor: Christine Alvarado

Students: Jesse Bellister (PM-S), Erik Kuefler, Jose Moreno (PM-F), Scott Parkey

Genius.com provides e-mail tracking for sales and marketing professionals so they can track their customers' interests and keep in contact with them. Unfortunately, these tracking techniques cannot distinguish between the original recipient and those to whom the e-mail was forwarded, which leads to confusion when the marketer contacts the customer based on this mixed information. We developed a decision tree algorithm to distinguish between different e-mail recipients in real-time and a user interface to display our results.

LinkedIn Corporation

Building A Replicated Transaction Log Library

Liaison: Jean-Luc Vaillant

Advisor: Ran Libeskind-Hadas

Students: Andrew Carman (PM-F), Andrew Farmer, Greg Farnum (PM-S)

In the era of cloud computing, many of us take our data for granted that once data has entered the cloud we consider it safe from loss. Companies providing cloud-based services work hard to try and maintain these guarantees, but many of their methods are based on things that "probably" work. We present Zab, a replicated transaction log library that provides safe data logging and guarantees consistency.

* "(TL)" Indicates Team Leader
"(PM)" Indicates Project Manager

magnify360

Maximizing Yield in the Shopping Cart by Predictive Modeling of Individual User Behavior

Liaisons: Olivier Chaine '95, James Healy, Nate Pool, Gilles Marchand

Advisor: Zachary Dodds

Students: David Lapayowker, Marissa Quitt, Elaine Shaver (PM-S), Devin Smith (PM-F)

magnify360 provides the most sophisticated marketing optimization platform for the modern Web. Featuring Predictive DNA™ technology, magnify360 dramatically outperforms traditional conversion optimization tools by personalizing each visitor's browsing experience in real-time. The self-learning system immediately adapts Web site content, layout and page flow based on an individual's behavior on-site, ultimately driving them toward a specified call to action. The goal of this project was to investigate new algorithms as possible solutions for the next generation of the magnify360 self-learning system.

The Platform for Media

Building a Domain-Specific Language for Media Publishing

Liaisons: Dave Edelstein, Paul Meijer, Nick Rossi '93

Advisor: Geoff Kuenning

Students: Robert Eckert (PM-F), Ace Ellett (PM-S), Andrew Hunter, Martin Pyne

We designed a domain-specific programming language for modeling the workflows of media publishing, and implemented a compiler for realizing those workflows. Our programming language allows media distributors to concisely specify their business logic for bringing media from internal production to Internet release. Our compiler translates that specification into tools that use thePlatform's products to implement that logic.

* "(F)" Fall Semester
"(S)" Spring Semester

QUALCOMM Incorporated

Management Data Repository for Open Source Network Management

Liaisons: Saravanan Balasubramanian, Hanu Pathuri, Ramesh Sathyanarayana

Advisor: Mike Erlinger

Students: Ben Jencks (PM-S), Joshua Peraza, Sergey Tsalkov (PM-F)

Providing large, networked services involves the operation of many smaller components. A network management system can help quickly diagnose problems when a component fails. In a large network, it is useful to distribute work across several smaller networks, each with their own network management system. The Configuration Management Database Federation (CMDBf) defines a web service to allow communication between different data repositories. We set out to extend Zenoss, an open source network management system, to provide the CMDBf web service.

COMPUTER SCIENCE/ MATHEMATICS CLINIC

Community of Ordinary differential Equations Educators (CODEE)

ODE Toolkit: Deployment of Software to Aid the Teaching and Learning of Ordinary Differential Equations

Liaison: Darryl Yong '96

Advisor: Christopher Stone

Students: Eric Doi (PM), Steven Ehrlich, Richard Mehlinger, Andres Perez

ODE Toolkit is a program for solving and teaching Ordinary Differential Equations. Over the past five years, CODEE has employed students at Harvey Mudd as developers. Unfortunately, weak architectural foundations and insufficient documentation have led to an unwieldy code base and significant development overhead. Our primary goal is to apply standard software engineering principles to reduce the burden of maintenance and upgrading. Additionally, the code will be prepared for open-source release to encourage the use and development of ODE Toolkit.

ENGINEERING CLINIC

9:Fish Surfboards

Manufacturing Process for a Recyclable Surfboard

Liaisons: Wesley Negus, Sunny Trinh '92/93
Advisor: Joseph King
Students: Daniel Bobrowsky (F), Rebecca Burns (TL-S), Takumi Ito (S), Megan Pham (S), Joshua Ray (S), Florian Scheulen (F), Scott Smith (TL-F)

The current surfboard manufacturing process requires materials and chemicals that pose both environmental and health risks. 9:Fish Surfboards sponsored a clinic project in 2007-08 to address these issues, and a board using more durable, recyclable components was produced. This year's team was tasked with revising the design for manufacture and creating an automated manufacturing process. The result is a manufacturing process for a revolutionary recyclable surfboard design.

The Aerospace Corporation

Picosatellite Wireless Communication

Liaison: Samuel S. Osofsky '85
Advisor: John I. Molinder
Students: Tony Evans (TL), Angus Ho (S), Kelley Hodges, Andrew Pozo (F), Jake Rowley (S), Dorian Scrima (F)

Picosats, each weighing a little over one kilogram, have been developed by the Aerospace Corporation to perform space missions such as inspecting the exterior of the space shuttle. Currently, these small satellites are launched in tethered pairs with no attitude control and no direct communication link between satellites. A wireless system including required hardware and software to provide a cross link between multiple picosats has been developed

AeroVironment, Inc.

Increased Covertness of Small Unmanned Aerial Vehicles

Liaisons: Noel Godinez '08, Dave Wilbur '68
Advisor: Donald S. Remer
Students: Hayden Gomes (TL), Greg Herschler, Michael Ho (S), Ibbey Shaikh, David Su

AeroVironment Inc. is seeking to develop new technologies for improving the covertness of their Small Unmanned Aerial Vehicles (SUAV). This project is focused primarily on visual and auditory concealment of SUAVs from human observers aided only by their naked eyes and ears. The team selected two designs to develop during the course of the project: LED illumination and motor isolation mounts. The deliverables will be a proof of concept that can be applied to AeroVironment's SUAVs.

Cardinal Health

Respiration Sensing

Liaison: Robert Siefert
Advisor: Anthony Bright
Students: Julien Dage (EX), Lua Del Campo (F), Alex Grammar (S), Raquel Robinson (S), Michael Ross (TL-F), Sidney Scanlon, Jinsun Yoo (TL-S)

The purpose of the Cardinal Health respiration sensing clinic project is to develop a device to sense respiratory behavior in hospital patients. The device must be small in physical dimensions, capable of continuous wireless transmission, and comfortable to wear. The overall system should be cost effective with the intent of producing disposable sensing components.

- * "(TL)" Indicates Team Leader
- "(PM)" Indicates Project Manager

Center for Integration of Medicine and Innovative Technology (CIMIT)

Design and Development of an Integrated Clinical Environment Supervisor (ICES) for Trauma Care

Liaisons: L. Alex Pranger '92/93, Bill Wiesmann
Advisor: Patrick Little
Students: Kevin Hsu (S), Janet Komatsu (TL-F),
Chris Koo (S), Mary Moore-Simmons
(F), Bunmi Olunloyo (EX), Jessica
Wen (F), Andrew Wong (TL-S)

The HMC 2008-2009 CIMIT Clinic team project is to develop an Integrated Clinical Environment Supervisor (ICES) for use by combat medics. The ICES is a portable device carried on the medic, and will monitor patients' conditions by communicating with several necessary medical devices such as an IV pump and blood pressure cuff. The ICES will also deliver decision-support for suggested treatments and direct the medical devices to administer treatments to multiple patients simultaneously.

Cobham; Sargent Fletcher Inc.

Design of Test Firing Apparatus for Pneumatic Ejection Racks

Liaison: Steve Sghayer
Advisor: R. Erik Spjut
Students: Trevor Ashley, Roger Billingsley (F),
Donald Bolton (S), Charles Gastil (TL),
April Hui

Redesign of the organization and apparatus for test firing of the BRU-61/A Pneumatic Ejection Rack, which carries and ejects the Small-Diameter Bomb from aircraft. Designing retractable loading floors, a new cushioning mechanism, and mechanical and electrical adaptors to greatly increase testing throughput in the current test area.

DirecTV, Inc.

Aiding the Satellite Dish Installation Process

Liaisons: David Kuether, Gustave Stroes
Advisor: Clive L. Dym
Students: Raffi Attarian (S), Daniel Bujalski (S),
Jaakko Karras (F), Michael Martin
(TL-S), Jonny Simkin (F), Justin White
(TL-F)

For a satellite dish antenna to be properly installed, the antenna must have clear line of sight to the satellites providing it content. Additionally, the support mast that it sits on must be plumb, or the dish will point in the wrong direction. The Harvey Mudd clinic team has been charged by DirecTV to create a Line of Sight device to identify line of sight risks, and a Digital Inclinometer to aid in plumbing the support mast.

Honeywell Aerospace

Aerospace-Grade Induction Motor Tester

Liaisons: Thay Chau, Pete Fizer
Advisor: Ziyad Duron '81
Students: Brian Bosak (S), Masato Kocberber
(S), Graham Orr (TL-S), Bryan Teague
(F), Jessica Witt (F), Eric Young
(TL-F)

Honeywell Aerospace is a producer of high performance electrical induction motors for a variety of specialized aerospace applications. During fabrication small manufacturing imperfections can occur inside the motor's rotor, decreasing overall performance. This project entails the simulation, design, and construction of an inductive electro-magnetic imaging system to detect and quantify imperfections in inductive rotors.

* "(F)" Fall Semester
"(S)" Spring Semester

* "(EX)" Exchange Student

Intel Corporation

CMOS Public-Key Cryptography

Accelerators

Liaisons: Ram Krishnamurthy, Sanu K. Mathew
Advisor: David Money Harris
Students: Michael Braly (TL-F), Nathan Jones (S), Julien Massas (EX), Trevin Murakami, Alexandra Simoni (TL-S)

Intel is exploring cryptography accelerators and has sponsored a two year project at Harvey Mudd College. Previous research has focused on processing elements, the central component of a cryptography accelerator. The Intel Clinic Team was tasked with designing and building an integrated circuit to measure the delay, energy, and area of the proposed processing element designs. They will share their general methodology, simulation results, and plans for the future.

Los Alamos National Laboratory

Development of a Diagnostic Wire Scanner for a Linear Particle Accelerator

Liaisons: Mike Borden, Doug Gilpatrick, Mark Gulley, James Sedillo, Brian Smith
Advisors: Lori Bassman, Trinh Pham (CSULA), Arturo Pacheco Vega (CSULA),
Students: Scott Butters, Sam Gordon (TL-S), Kenny Quinn (TL-F), Julio Celada (TL-S-CSULA), Gilbert Magaña (TL-F-CSULA), Sergio Rodriguez (CSULA)

The team has developed a diagnostic wire scanner for use on the half mile long linear particle accelerator at Los Alamos National Laboratory. Wire scanners provide information that is used to help focus the accelerator's proton beam by moving quickly and accurately through its cross section and using secondary emissions to create a beam intensity profile. The team has worked to improve on current wire scanner designs by implementing closed loop feedback control to position the device, using linear guides to keep it steady, and experimentally comparing the use of both stepper and servo motors in the design.

* **“(TL)” Indicates Team Leader**
“(PM)” Indicates Project Manager

National Optical Astronomy Observatory (NOAO)**

Ultra-Low Noise Digital Readout System for a CCD Telescope

Liaisons: Mark Hunten, Peter Moore, David Sprayberry
Advisor: Carl Baumgaertner
Students: Leah Anderson (TL), Ian Bullock (S), Shawn Dueñas (F), Ben Keller (S), Mobashwir Khan (F), Julien Valentin (EX)

Astronomers presently use charge coupled devices (CCD's) to capture and record telescope images. NOAO is seeking a CCD readout system that is faster and more accurate than their current system. At extremely high speeds, the existing analog noise filters do not function as effectively as is required for many scientific applications. We have designed and tested a novel readout and noise-reduction system that oversamples the CCD output signal to provide more accurate, high-speed digital processing.

Nike, Inc.

Design of Cleatless Soccer Shoes

Liaison: Brian Baker
Advisor: Nancy Lape
Students: Kevin Festini (TL-S), Alex Kurtis Jr. (F), Kacy McKibben, Michael McNeece (S), Daniel Rodriguez, Victoria Wu (TL-F)

Cleats on soccer shoes desensitize feel on the ball and cause many injuries. The goal of the project is to design a cleat-free soccer shoe that achieves the same traction properties as conventional soccer shoes today. The design also must achieve these traction properties on any playing surface. Furthermore, the project solution must not have protrusions greater than three millimeters. The team has created and tested a variety of design alternatives to satisfy these conditions.

** NOAO is operated by the Association of Universities for Research In Astronomy under a cooperative agreement with the National Science Foundation.

Nike, Inc.

In-Store Assembly and Customization of Footwear

Liaisons: Ciro Fusco, Amy Gishifu, Bruce Kilgore, David Schenone

Advisors: Joseph King (F), Patrick Little (S), Jacqueline El-Sayed (S)

Students: Bryan Downs (S), Sarah Nitzan (F), Alyssa Pierson (F), Timothy Sweda (TL-S), Michelle Walker (S), Anthony Wimer-Maniagio (TL-F)

One current problem with retail footwear sales is the limited availability of customization options. Consumers strive to achieve a balance among aesthetics, comfort, fit, and performance, but too many compromises will leave a customer not feeling fully satisfied with his or her purchase. Nike has tasked our team with developing a method for assembling footwear products at the point of sale to facilitate customization.

Northrop Grumman Corporation

Point to Point Wireless Communication Interface to Test Navigation Systems

Liaisons: Todd Uramoto, William Vanier

Advisor: Samuel DiMaggio

Students: Andrew Armas (S), Benjamin Bergstedt, Michael Lee (F), Daniel Lim (TL), Benjamin Smith (S), Michael Van Antwerp

Northrop Grumman currently calibrates and tests navigation systems with gimbaled test fixtures to maintain wired connectivity on rate tables. The goal of this project was to design and develop a prototype point to point wireless interface that would replicate the current wired setup. This entailed the design and construction of a prototype wireless system that could withstand the rigorous testing conditions.

* “(F)” Fall Semester
“(S)” Spring Semester

Oregon Biomedical Engineering Institute (OBEI)

Advanced Hemostatic Agent Delivery Device (AHADD)

Liaisons: Kenton Gregory, Genevieve Mueller, Teresa Pineda ‘06

Advisor: Nancy Lape

Students: Lauryn Baranowski (TL-F), Grant Blackwell (EX), Steven Dell (F), Arjun Kalyanpur (TL-S), Ben Margolis (S), Seanna Vine

According to the U.S. Army Institute for Surgical Research, uncompressible hemorrhage injuries are the leading cause of death on the battlefield today. The HMC Clinic team will design and prototype a device that will deploy a controllable amount of fast-acting hemostatic agent into non-abdominal wounds of varying severity without applying detrimental pressure to the cavity and surrounding tissues. This device should be safe, portable, durable, and disposable, as it will be carried by military medics in a battlefield environment.

Oregon Biomedical Engineering Institute (OBEI)

Automated Nanofiber Vascular Fabrication Device

Liaisons: Kenton Gregory, Kathy McKenna, Teresa Pineda ‘06, Rebecca Sarao, Ping-Cheng Wu

Advisor: Elizabeth Orwin ‘95

Students: Lucia Cheung (TL-F), Masanori Honda (F), Benyue Liu (F), Benjamin Taborsky (TL-S), Alex Young (S), Clark Zhang (S)

The team's goal is to automate the electrospinning process used at OBEI to create artificial blood vessels for vascular grafts. The team has designed a state-of-the-art system and is using LabVIEW to integrate and control all of its components. The final product will include a user friendly GUI designed to make it useful with very little training for technicians or experimentalists.

* “(EX)” Exchange Student

Orthodyne Electronics

Modeling the Viscoelastic Behavior of Vibration Isolation Mounts for an Ultrasonic Wire Bonder

Liaison: Eric Scranton

Advisor: Philip Cha

Students: Jane Chen, Nicolas Hasegawa (F), Jackie Lam (S), Thomas Oh (S), Andrew Sabater (TL), Brad Witkowski

Develop mathematical models that can be used to characterize the viscoelastic isolation mounts on Orthodyne Electronics' 3600Plus ultrasonic wire bonder. The models are constructed using experimental force and displacement data, and they predict the transient settling behavior of the isolation mounts for a bandwidth limited set of forcing frequencies. Construct an experimental setup that represents a simplified version of the wire bonder. Validate the models by comparing the experimental transient displacement of the setup with the predicted response for each model.

Southwest Research Institute

Time-of-Flight Measurements Using FPGAs

Liaison: Jörg-Micha Jahn

Advisor: Sarah Harris

Students: Whitney Hsiong (TL-F), Steve Huntzicker (TL-S), Kevin King (S), Austin Lee (F), Chen Lim (S), Jason Wang (F)

The Space Sciences division of SwRI is interested in determining the time-of-flight (ToF) of sub-atomic particles between parallel sheets of foil in space. Currently SwRI uses Application Specific Integrated Circuits (ASICs) for this purpose. The purpose of this clinic project is to save costs by implementing the same type of ToF system with a nanosecond resolution on a much less expensive Field Programmable Gate Array (FPGA).

Space Systems/Loral

Modeling Shock Attenuation in Spacecraft Panels

Liaisons: Adam Maher, Mark Zanella

Advisor: Samuel DiMaggio

Students: Vatche Attarian (TL-F), Caroline Fernandez, Liz Flannery, Alex Krause (S), Shannon McKenna (TL-S), Christopher Nield (F)

Space Systems/Loral, a leading aerospace company, designs and manufactures satellites. A better understanding of how shock, or a high frequency event, affects their products will enable more comprehensive design and testing of spacecraft. The team will develop and execute a series of tests including variations in distance, mass and material to evaluate the shock response of a panel. The data gathered from the tests will be analyzed and used to construct empirical models of shock attenuation through panels.

SRI International

Development of Barometric Altimetry System for Personnel Tracking

Liaisons: Gerald Lucha, Michael Saldana '07

Advisor: Mary Cardenas

Students: Steven Dell (F), Alan Gilder (S), Matt Kurtis (F), Jonathan Lake (TL-S), Ryan Quarfoth (TL-F), Daniel Taller (S), Lou Zellinger (F)

SRI International is developing a system for indoor personnel tracking. The HMC clinic team has evaluated commercial barometric pressure sensors and their ability to identify the altitude of an individual within a building. The project involved researching and testing barometer alternatives, and analyzing pressure errors and fluctuations within buildings. After choosing and testing a sensor, the team worked to integrate the sensor into existing SRI International systems.

* “(TL)” Indicates Team Leader

Three Valleys Municipal Water District (TVMWD)

Use of Alternative Energy Sources at Three Valleys Municipal Water District

Liaisons: Ray Evangelista, Mike Sovich

Advisor: Donald S. Remer

Students: Rob Best (S), J.J. Boyles (F), Alicyn Henkhaus (TL-S), Claire O'Hanlon (TL-F), Autumn Petros-Good, Alex Randall (F)

Three Valleys Municipal Water District would like to increase the amount of renewable energy they generate at their Miramar treatment facility by installing photovoltaic solar panels. To achieve this goal, the clinic team is working with an outside contractor to install a pilot system that will provide 2 kW of power at the Three Valleys site. The team is also developing an expansion plan so Three Valleys can install 110 kW of solar panels in the future.

TREX Enterprises Corporation

In-Building Tracking of Emergency Rescue Personnel

Liaisons: Laura Angell '06, Paul Johnson, Vladimir Kolinko, Hope Runyeon '06

Advisor: Ruye Wang

Students: Corinne Cho(S), Jordan Ciciliano (F), Hector Cuevas (TL-F), Jin-Soo Jo (S), Sean Kim (S), Andrew Lawrence (TL-S), Kevin Lee (F)

The Trex Enterprises clinic team will develop a proof of concept system that will utilize radio frequency signals to track emergency personnel in various environments. Hardware will be built to measure the ranges between base stations and a personal transceiver by measuring the phase difference between the signal transmitted by the base stations and the signal returned by the transceiver. The personnel's coordinates will be computed using software that trilaterates the ranges from the transceiver to various base stations.

* **“(F)” Fall Semester**
“(S)” Spring Semester

GLOBAL CLINIC

Applied Biosystems Inc.

Low Cost Real-Time Polymerase Chain Reaction Instrument for Educational Market

Liaisons: Zainal Abidin, Mark Oldham

Advisors: Shenda Baker, Patrick Little

Students: Mark Hubenschmidt, Oliver Johnson (TL), Anna Lei

This project is a continuation of last year to build a low-cost real-time Polymerase Chain Reaction (RT-PCR) machine designed to educate high school students. RT-PCR is the process used to concentrate a specific strand of DNA. The project goals were to optimize the existing prototype, incorporate a robust biochemical protocol, and create the firmware and user interface. The HMC team built and tested a prototype with automated thermal cycling, stable temperature control, and finer resolution for reading DNA concentration.

Lien Institute for the Environment

Design of a Household Level Arsenic Treatment System for Rural Cambodia

Liaison: Chai Kok Chiew

Advisors: Darryl Yong '96

Students: Catherine Bradshaw (HMCTL-S), Annika Eberle (HMC/TL-F), Eveline Ekklesia (NTU), Chun Heng Loh (NTU), Hui Qing Soh (NTU), Camille Sultana(HMC-S), Maggie Weber (HMC/TL-Summer)

Arsenic concentrations in Cambodian groundwater can be one hundred times greater than the World Health Organization's standard of 10 ppm. While there are several arsenic treatment methods currently used in developed countries, these methods are not suitable for rural Cambodia. In collaboration with students from Nanyang Technological University in Singapore, the team developed a culturally-relevant treatment method for rural Cambodia by adapting solutions from well-documented primary research. A proof-of-concept prototype was constructed using materials available locally in Cambodia.

KGI/ENGINEERING CLINIC

Syngenta

Automated Design for Single Seed Handling

Liaison: Kirk Noel

Advisors: Anna Hickerson (KGI)

Students: Pierre-Alain Blossé (KGI-S), Marc Davidson (S), Caro De Freitas (S), Chelsea Drenick (F), Wesley Ducey (F), Max Myers (TL), Kristina Roskos (KGI), Brent Thomson (KGI-F)

Syngenta is an agribusiness that breeds seeds for farmers. The company uses near infrared spectroscopy to select specific phenotypic traits during breeding. The machine used to perform this spectroscopy must be attended continuously for several hours by a technician. In order to reduce labor, Syngenta had the team automate the seed sorting process. This involved presenting a single seed from a bulk source to the machine, scanning the seed, and then removing it and sorting it accordingly.

MATHEMATICS CLINIC

Chicago Trading Company

Building a Multi-Agent Artificial Stock Market

Liaisons: Lewis Biscamp, Nader Varjavand, Long Hei

Advisor: Donald Williams

Students: Rishad Manekia (PM), Edwin Lei, Kevin Oelze, Jane Pan

We design and build a multi-agent multi-asset stock market simulator using an object-oriented software development paradigm. The simulator employs a software driven market mechanism, which handles transactions for instantiated agents based on market and limit orders for multiple correlated assets. Using evolving trading strategies within the simulator, we establish a behavioral model for decision analytics that facilitates statistical inferencing and insight into the dynamics of financial markets and the agents operating therein.

* “(TL)” Indicates Team Leader
“(PM)” Indicates Project Manager

Citadel Investment Group

Optimizing Pairs Trading Portfolios

Liaison: Michael Schubmehl ‘02

Advisor: Francis Su

Students: Brett Cooper (PM-S), Chris Fox, Denis Aleshin (J), Joshua Klontz (J), Bryce Lampe (J), Maria Pavloskaia (PM-F), Patrick Foley (Consultant)

We studied a method of statistical arbitrage known as pairs trading, and developed an automated strategy for quantitatively constructing a portfolio of pairs that attempts to minimize risk while maximizing expected returns. Our work builds on the research done by the 2007-2008 Pairs Trading Clinic Team. While last year's focus was to implement a basic pairs trading strategy and optimize parameters, this year's emphasis is on controlling risk.

Laserfiche

Deblurring: Removing Image Distortion Induced by Camera Motion

Liaisons: Ryan Wong ‘89, Kurt Rapelje, Karl Chan

Advisors: Darryl Yong ‘96, Weiqing Gu (Consultant)

Students: Aaron Abromowitz, Richard Bowen (PM), Donavon Huskey, Brett McLarnon

Blurring is a major challenge preventing people from using digital cameras in place of scanners to capture documents. To help Laserfiche offer this capability in their document management suite, we have created software that automatically deblurs images without any knowledge of the motion causing the blur. Our solution is a modified version of a recently published natural image deblurring algorithm that exploits underlying patterns in images of text. We have also improved the runtime performance of the original algorithm.

* “(KGI)” Indicates Keck Graduate Institute

PHYSICS/ENGINEERING CLINIC

Lawrence Livermore National Laboratory

Calibration Source for a Prototype Car- Wash Detector of Fissile Material

Liaisons: Adam Bernstein, Steven Dazeley

Advisors: Richard Haskell, Ruye Wang

Students: Lupita Bermudez (S), Elizabeth Ellis,
Jonathan Hubbard, Rachael Martin,
Reuben Villagomez (TL)

The joint Physics-Engineering clinic team has designed and constructed a waterproof, tagged neutron source for the purpose of calibrating a new type of neutron detector currently in development at LLNL. The calibration of the LLNL detector is required to verify that its efficiency is maintained as the detector is scaled up to the size required for security scanning at major ports of entry as part of a program aimed at non-proliferation of fissile material.

PHYSICS/MATHEMATICS CLINIC

Cardinal Health

Modeling Fluid Transport in Subcutaneous Tissue

Liaison: Robert Butterfield

Advisors: Richard Haskell, Rachel Levy

Students: Harry Dudley, Stephen Rosenthal (PM-
F), Brian Stock (PM-S), Melissa Strait

The goal of this project is to produce a mathematical model of fluid flow in subcutaneous tissue. Two models have been developed: a compartment model that segregates the fluid into homogeneous regions, and a continuous model that describes the properties of the fluid at each point in space and time.

