

HARVEY MUDD

C O L L E G E

2005 PROJECTS DAY

Tuesday, May 3rd

10:30 a.m. to 6:00 p.m.

**Harvey Mudd College
301 Platt Boulevard
Claremont, CA**

THIRTY-FIFTH ANNUAL PROJECTS DAY

Projects Day is dedicated to Jack Alford and Mack Gilkeson for their foresight and wisdom in the creation of the Harvey Mudd College Clinic Program.

The Computer Science, Engineering, Mathematics, and Physics 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

Michael Raugh, Director
Mathematics Clinic

Richard Haskell, Director
Physics Clinic

HARVEY MUDD COLLEGE PROJECTS DAY May 3, 2005

Program

10:30 a.m.	Registration and Poster Viewing	Linde Activities Center
1:00 p.m.	General Session	Galileo/McAlister
	Welcome - Jon Strauss, President	
	Remarks - Robert Keller Director, Computer Science Clinic	
	Milestone Awards - Thomas Helliwell, Interim Dean of Faculty	
	<u>Recipients:</u>	
	The Aerospace Corporation - 20 Projects	
	Applied Biosystems - 5 Projects	
	Fair Isaac Corporation - 10 Projects	
	Federal Aviation Administration - 10 Projects	
	Jet Propulsion Laboratory NASA - 30 Projects	
	QUALCOMM - 10 Projects	
	Sandia National Laboratories - 10 Projects	
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							
The Aerospace Corporation							
<i>Grid-Enabling the VISPERs Application</i>	x		x		x		Pryne
Applied Biosystems							
<i>Polymerase Chain Reaction Net Software Version 2 . . .</i>	x		x		x		B-B134
The Boeing Company GPS IIF Control Segment							
<i>Modeling and Simulation of GPS</i>	x		x		x		B-B126
Fair Isaac Corporation							
<i>Constrained Optimization in Convex Programming . .</i>		x		x		x	B-B134
Google							
<i>Differential Test Coverage Analysis in the Context of the Wine Project</i>		x		x		x	B-B105
Laserfiche							
<i>Distributing Search in a Document Database</i>	x		x		x		B-B105
Sandia National Laboratories							
<i>Mesh Optimization Algorithms for Parallel Computing with MESQUITE</i>		x		x		x	Pryne

ENGINEERING CLINIC

The Aerospace Corporation							
<i>An Extended Range A/D Assembly</i>	x		x		x		P-1285
Applied Biosystems							
<i>Bubble Formation in Microfluidic Chambers</i>		x		x		x	McAlister
Center for Integration of Medicine and Innovative Technology (CIMIT)							
<i>Design of a Prototype Cooling System to Prolong and Preserve Limb Viability</i>	x		x		x		P-1264

Building Codes:
 B = Beckman Galileo-Edwards = Edwards
 P = Parsons Galileo-McAlister = McAlister
 Galileo-Pryne = 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	4:30	
ENGINEERING CLINIC							
Defense Advanced Research Projects Agency (DARPA)							
<i>Proprioceptive Feedback System For Lower Limb Amputees</i>		x		x		x	P-1277
Federal Aviation Administration LED							
<i>Enhanced LED Airport Approach Lighting System . . .</i>	x		x		x		P-1287
Federal Aviation Administration VOR							
<i>An Integral Monitoring System for the Very-High-Frequency Omni-Directional Range (VOR) Aircraft Navigation System</i>		x		x		x	P-1275
Fluidmaster, Inc.							
<i>Innovative Designs for Flushing Systems</i>	x		x		x		P-1283
Honeywell							
<i>Determination of Duct Flow Characteristics Across Heat Exchanger Cores</i>	x		x		x		P-2375
Irvine Ranch Water District							
<i>Alternative SCADA Backup Methods for Reservoir Monitoring</i>		x		x		x	P-2375
Jet Propulsion Laboratory NASA							
<i>Antarctic Plateau Interferometer Concept Study</i>		x		x		x	P-1264
Lawrence Livermore National Laboratory							
<i>Hydrogen Embrittlement of Wires in a Neutron Time Projection Chamber</i>		x		x		x	P-1283
Lockheed Martin Advanced Technology Center							
<i>Creating a Computer-Controlled Active Tracking Heliostat</i>	x		x		x		P-2358
Los Alamos National Laboratory							
<i>Variable Pulsed Laser Delay Line for Flash Photography of Mesoscopic Spatial Dynamics</i>	x		x		x		P-B171
Medtronic MiniMed							
<i>Occlusion Detection Algorithm Development in Insulin Pumps.</i>	x		x		x		P-1277
Northrop Grumman Navigation Systems							
<i>External Fiber Optic Modulator</i>		x		x		x	P-B181
Northrop Grumman Space Technology							
<i>Passive Millimeter Wave Lens Testing Automation</i>	x		x		x		P-2383
Oregon Medical Laser Center							
<i>Optical Tumor Location Device</i>	x		x		x		McAlister
QUALCOMM							
<i>ZigBee Digital Modem Suitable for Cellular Phone Platform</i>		x		x		x	P-2383
Raytheon Space and Airborne Systems							
<i>Hyperspectral Image Data Processing Algorithms: Developing a Characterization Process</i>		x		x		x	P-1285

Project	Time						Location
	1:30	2:00	2:30	3:30	4:00	4:30	
Sandia National Laboratories <i>Augmented HVAC Sensors for Near-Real-Time Modeling of Dispersed Airborne Materials in Buildings</i>		x		x		x	P-2358
Sierra Wireless America, Inc. <i>Ethernet - to - USB Bridge</i>	x		x		x		P-1275
Space Systems/Loral <i>Design and Vibration Characterization of a Passively Damped Satellite Bracket</i>	x		x		x		P-B181
UVP, Inc. <i>Uniform Illumination for Fluorescent In Vivo Imaging</i>		x		x		x	P-1287
MATHEMATICS CLINIC							
Applied Biosystems <i>Automated Analysis of Gene Expression Data</i>	x		x		x		Edwards
HP Labs <i>Analyzing and Correcting Printer Drift</i>		x		x		x	B-B126
PHYSICS CLINIC							
Sandia National Laboratories <i>Optical Characterization of Coated Soot Aerosols or Flames and Lasers</i>		x		x		x	Edwards

2004/2005 Clinic Sponsors

Computer Science

The Aerospace Corporation
Applied Biosystems
The Boeing Company
Fair Isaac Corporation
Google
Laserfiche
Sandia National Laboratories

Medtronic MiniMed
Northrop Grumman Navigation Systems
Northrop Grumman Space Technology
Oregon Medical Laser Center
QUALCOMM
Raytheon Space and Airborne Systems
Sandia National Laboratories
Sierra Wireless America, Inc.
Space Systems/Loral
UVP, Inc.

Engineering

The Aerospace Corporation
Applied Biosystems
Center for Integration of Medicine and Innovative Technology (CIMIT)
Defense Advanced Research Projects Agency (DARPA)
Federal Aviation Administration
Fluidmaster, Inc.
Honeywell
Irvine Ranch Water District
Jet Propulsion Laboratory
Lawrence Livermore National Laboratory
Lockheed Martin Advanced Technology Center
Los Alamos National Laboratory

Mathematics

Applied Biosystems
HP Labs

Physics

Sandia National Laboratories

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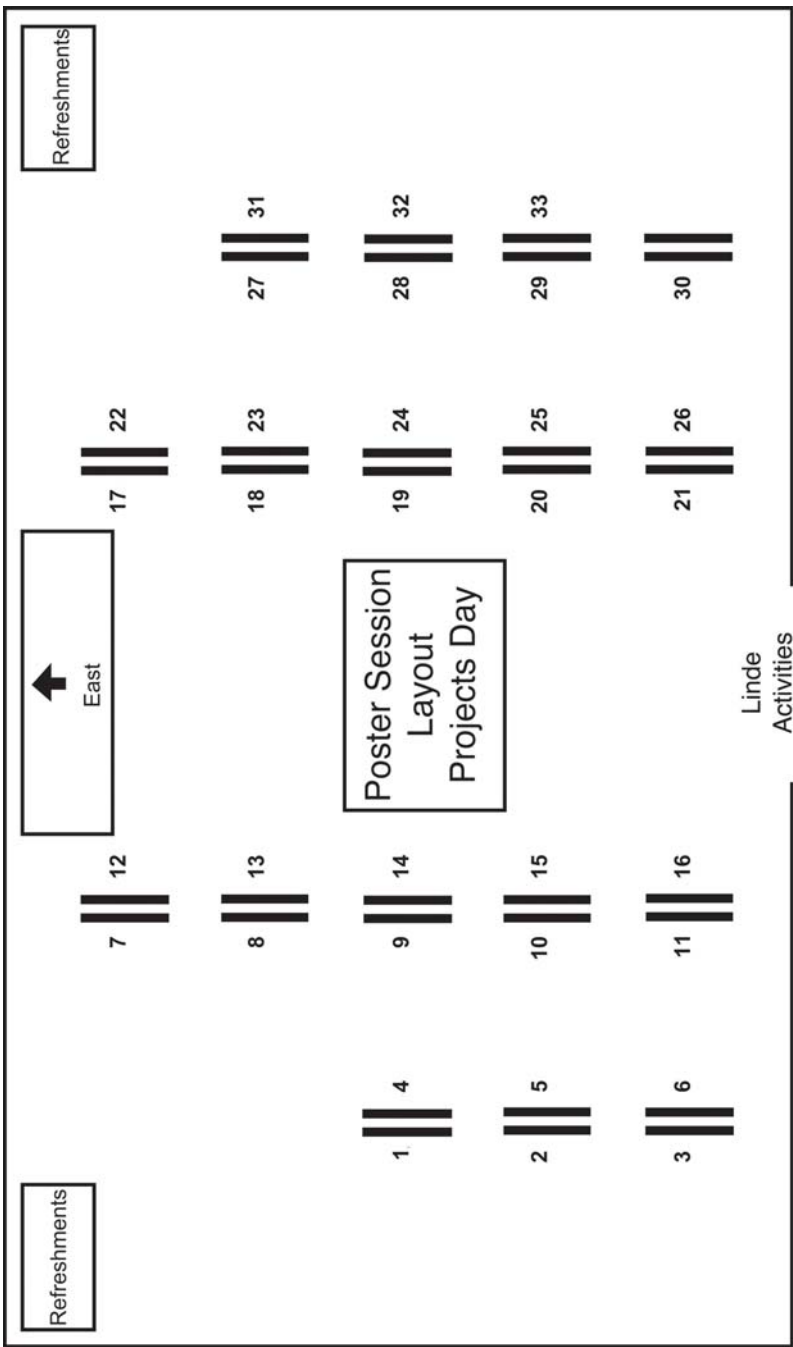
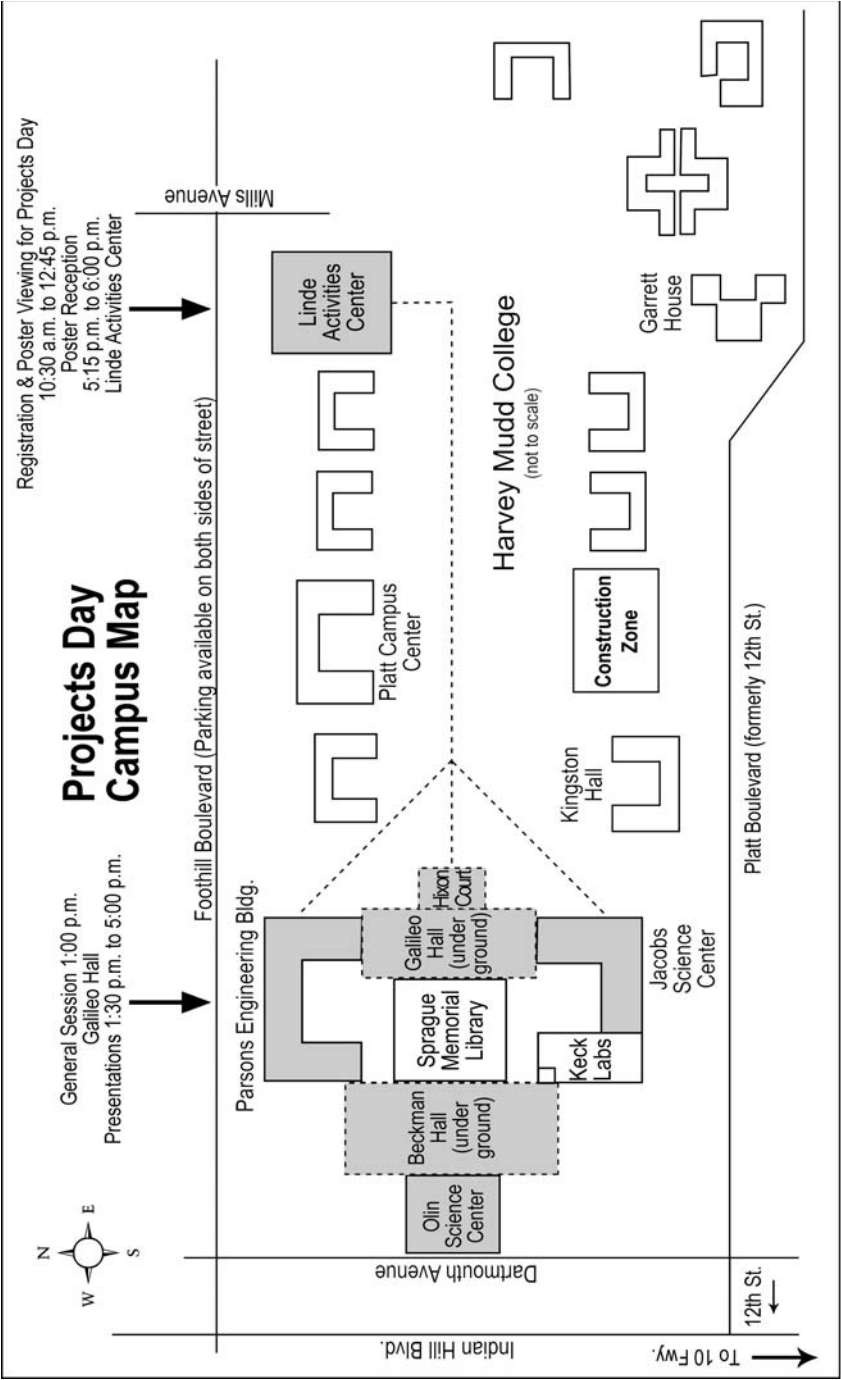
College Members:

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Richard Haskell, Director, Physics Clinic

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



Key to Poster Session Layout

1. The Aerospace Corporation (CS)
2. The Aerospace Corporation (Eng.)
3. Applied Biosystems (CS)
4. Applied Biosystems (Eng.)
5. Applied Biosystems (Math)
6. The Boeing Company GPS IIF Segment
7. Center for Integration of Medicine and Innovative Technology (CIMIT)
8. Defense Advanced Research Projects Agency (DARPA)
9. Fair Isaac Corporation
10. Federal Aviation Administration LED
11. Federal Aviation Administration VOR
12. Fluidmaster, Inc.
13. Google
14. HP Labs
15. Honeywell
16. Irvine Ranch Water District
17. Jet Propulsion Laboratory NASA
18. Laserfiche
19. Lawrence Livermore National Laboratory
20. Lockheed Martin Advanced Technology Center
21. Los Alamos National Laboratory
22. Medtronic MiniMed
23. Northrop Grumman Navigation Systems
24. Northrop Grumman Space Technology
25. Oregon Medical Laser Center
26. QUALCOMM
27. Raytheon Space and Airborne Systems
28. Sandia National Laboratories (CS)
29. Sandia National Laboratories (Eng.)
30. Sandia National Laboratories (Phy.)
31. Sierra Wireless America, Inc.
32. Space Systems/Loral
33. UVP, Inc.

COMPUTER SCIENCE CLINIC

The Aerospace Corporation

Grid-Enabling the VISPERS

Application

Liaisons: Joseph Betser, Robert Davis '91,
Matthew Presley '89, Jorge Seidel
Advisor: Robert Keller
Students: Brian Bentow (PM), Jon Dodge,
Aaron Homer, Chris Moore

The Clinic team designed and implemented a version of waveform analysis tool, VAIL, based on the “grid” highly-parallel computing paradigm, using the Globus toolkit. VAIL is part of a larger system that analyzes real-time sensor data to characterize the vibroacoustic shock environment of launch vehicles. We conducted a performance analysis of the grid-enabled tool, measured speedup, and analyzed communication bottlenecks. We also researched and surveyed the current state-of-the-art in grid computing tools and provided a study to facilitate future grid implementations by The Aerospace Corporation.

Applied Biosystems

Polymerase Chain Reaction Net

Software Version 2

Liaison: Andrew Byschenk
Advisor: Belinda Thom
Students: Jacob Seene (PM), Timothy Chew
(CMC), Krislin Lee, Paul Scott

Polymerase Chain Reaction (PCR) Net is a piece of software used to monitor and control GeneAmp PCR 9700 instruments. These instruments, in turn, are used to amplify DNA samples. Amplified DNA samples can be analyzed and then used in forensic analysis, gene sequencing, and genetic defect determination. Our team is enhancing PCRNet by improving the user interface, extending the error logging capabilities, and enabling core features of the application to be run across a local network.

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

The Boeing Company GPS IIF Control Segment

Modeling and Simulation of GPS

Liaisons: Darryl Nakata '86, Ryan Ripken
Advisor: Michael Erlinger
Students: Victoria Krafft (PM), Tarun
Abhichandani (CGU), Brian
Meridian, Trudi Miller (CGU),
Sonya Zhang (CGU)

The current United States Air Force’s Global Positioning System (GPS) consists of earth-orbiting satellites and a world-wide network of monitoring stations. The Clinic team has developed a simulation model representing the GPS network using the OPNET network modeling platform. The model has been verified via data provided by Boeing and other sources. The team has created a set of “what if” scenarios and applied them to the GPS model to evaluate possible modifications to the GPS infrastructure.

Fair Isaac Corporation

Constrained Optimization in Convex Programming

Liaison: Frank Elliott
Advisor: Ran Libeskind-Hadas
Students: Brian Tagiku (PM), Dave
Buchfuhner, Dan Halperin, Brad
Tennis, Chris Weisiger

Fair Isaac Corporation provides companies with mathematically-based solutions for a variety of business problems. Many of these problems can be modeled using quadratic programs with large numbers of variables and linear constraints. The Clinic team has taken on the task of developing a prototypical software package that solves linear and quadratic programs. A number of algorithms have been incorporated into this package to accurately solve these types of problems.

* (CMC) Claremont McKenna College
(CGU) Claremont Graduate University

Google

Differential Test Coverage Analysis in the Context of the Wine Project

Liaison: Dan Kegel
Advisor: Elizabeth Sweedyk
Students: Cal Pierog (PM), Aaron Arvey (CMC), Edward Kim, Evan Parry

This project will help ensure that Google's Windows applications run properly under Wine, which is a program that allows Windows programs to run under Linux. The team improved coverage tools to identify areas of untested code used by an application. The team also used these new tools to identify bugs in Wine that affect Google applications, focusing on the Picasa application.

Laserfiche

Distributing Search in a Document Database

Liaisons: Kurt Rapelje, Karl Chan '89
Advisor: Zachary Dodds
Students: Adam Kangas (PM), Janna DeVries, Joseph Walker, Kamil Wnuk

As organizations make the shift from paper documents to electronic document imaging systems, the size of electronic document repositories is constantly growing. This team has researched distributed methods for reducing the amount of time required to perform full-text searching in large document databases.

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

Sandia National Laboratories

Mesh Optimization Algorithms for Parallel Computing with MESQUITE

Liaison: Patrick Knupp
Advisor: Melissa O'Neill
Students: Dominik Slusarczyk (PM), Elisa Celis, John Hicks, Yu-Min Kim

This Clinic project extended the MESQUITE mesh smoothing toolkit developed by Sandia National Laboratories to operate on a distributed processing cluster. Parallel smoothing requires efficient partitioning of meshes into subparts, correct smoothing of those subparts, and effective cross-cluster synchronization during and after computation. The project drew on existing research in the field of distributed mesh smoothing and on established tools, including MESQUITE itself, the Zoltan partitioning toolkit, and the MPI toolkit for distributed computing. Distributed computation would be pointless without speedup over ordinary single-CPU computation, so the team has also developed and deployed performance analysis methods which have inspired further optimizations to the code.

ENGINEERING CLINIC

The Aerospace Corporation

An Extended Range A/D Assembly

Liaison: Samuel Osofsky '85
Advisor: David Money Harris
Students: Henry Chen (TL), Keane Kaneakua (S), Shane Ouchi, Chris Prounh (F), Amanda Rainer (S), Alexander Utter

Certain traditional systems that enhance the dynamic range of an analog-to-digital (A/D) converter require a tradeoff between precision, dynamic range, and system complexity. Using a novel approach that simplifies and optimizes these systems, the team has designed, built, and tested a high-speed A/D converter assembly that enhances the dynamic range of an 8-bit A/D converter while minimizing these drawbacks.

Applied Biosystems

Bubble Formation in Microfluidic Chambers

Liaison: Umberto Ulmanella
Advisors: Mary Cardenas, Jon Jacobsen
Students: Jacob Pinheiro (TL), Angela Cho, Don Lee, James O'Grady (S), Michaela Reagan (F), Mele Sato

The study of microfluidics is a growing discipline in fluid engineering, with many applications in medical and pharmaceutical industries. In these applications, the formation of bubbles in microfluidic reaction chambers is a major problem. A parametric study of the factors influencing bubble formation was completed through extensive experimentation and analysis. Computer simulations were compared with experimental results, with a mathematical model of bubble formation as the objective.

Center for Integration of Medicine and Innovative Technology (CIMIT)

Design of a Prototype Cooling System to Prolong and Preserve Limb Viability

Liaison: Alex Pranger '92/93
Advisor: Donald Remer
Students: Nicolas von Gersdorff (TL), Jay Chow, Mike Le (S), Robert Panish (S), Ajay Shah (F)

While combat armor advancements have increased soldiers' survival rates, modern weaponry ravages warfighters' extremities, causing massive trauma and tissue loss; 2/3 of the 10,000 combat injuries in Iraq and Afghanistan afflicted patients' limbs. Inducing local hypothermia upon injury would prolong limb viability, lengthening the window for soldiers to obtain restorative and regenerative care and thereby avoid amputations. The team has developed a lightweight, easily deployable, evaporative cooling wrap to induce therapeutic hypothermia on the battlefield.

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

Defense Advanced Research Projects Agency (DARPA)

Proprioceptive Feedback System For Lower Limb Amputees

Liaisons: William Wiessman M.D., Geoffrey Ling M.D., Adrian Urias '99/00
Advisor: Ziyad H. Duron '81
Students: Sophia Huynh, Lisa Jacobs (TL), Atsushi Kobayashi, George Korir (S), Karen Shi (F), Chris Wottawa

The Defense Advanced Research Projects Agency (DARPA) is funding the development of a rehabilitation device which utilizes mechanical feedback to provide lower limb amputees proprioceptive information from their prosthesis and its interaction with the outside environment. The Clinic team has designed and developed a prototype unit which mimics proprioceptor functions and provides the patient sensory feedback regarding location of the prosthetic in time and space.

Federal Aviation Administration (LED)

Enhanced LED Airport Approach Lighting System

Liaison: Calvin Miles '87
Advisor: Carl Baumgaertner
Students: Nicholas Carbone (TL), Ruben Betancourt (S), Mark Festini (F), Oliver Hou (S), Karen Hsin (S), Ko Ihara, Robert Sweney (F)

The FAA-LED team continues the development of a highly efficient LED airport approach lighting system to replace presently-used incandescent lamps. The improved system uses photodiodes and temperature sensors in a closed-loop system to compensate light levels for snow, rain, dirt and LED aging. Visual acquisition of the airport is improved with an innovative LED configuration and computer-controlled strobe sequences. Fuel cells are evaluated for use as backup power and a detailed economic analysis of the LED system is also performed.

Federal Aviation Administration VOR

An Integral Monitoring System for the Very-High-Frequency Omni- Directional Range (VOR) Aircraft Navigation System

Liaison: Nelson Spohnheimer
Advisors: John Molinder, Qimin Yang (F)
Students: Min Shim (TL), Brad Greer,
Robert Little (F), Kawika
Maunupau (F), Jessica Riley (S),
Wayne Tanaka (S)

Design, build, and test a system for monitoring the voltage standing wave ratio (VSWR) on VOR antenna feed lines to augment the prototype integral monitoring system developed by the 2003-04 project teams and currently installed at the Drummond, Montana VOR site. Perform a parametric analysis to determine the effect of various VOR system failures on VSWR and demonstrate the monitor's capability to detect some or all of these failures via computer simulation, use of the 535B VOR rack on loan to HMC from the FAA, and installation at the Drummond VOR site. Remotely collect and analyze data to verify the performance of the currently installed prototype. Suggest approaches for development of a production-ready design.

Fluidmaster, Inc.

Innovative Designs for Flushing Systems

Liaison: Chris Coppock
Advisor: Lori Bassman
Students: Joe Laubach (TL), Shawna
Biddick, Rami Hindiyeh (S), Joey
Kim, John Onuminya,
Sarah Taliaferro (F)

Fluidmaster Inc. is a worldwide supplier of plumbing products. The company is determined to aid in the conservation of scarce fresh water resources as well as to enable people worldwide to enjoy the health benefits of safe and reliable sanitation. This requires a cost effective flushing system that uses a consistent low volume of water regardless of variations in supply water pressure and toilet resistance. The Harvey Mudd College Fluidmaster Clinic team has designed and prototyped two concepts that accomplish this task.

Honeywell

Determination of Duct Flow Characteristics Across Heat Exchanger Cores

Liaison: Steve White
Advisor: Anthony Bright
Students: Daniel Pederson (TL), Michael
Bigelow (F), Daniel Lee, Emily
Ross, Benson Tsai (S),
Emily Vinding Nyden (S)

Honeywell has asked the team to explore the effects of various ducting configurations on the flow through a heat exchanger core to aid in the efficient design of future heat exchangers. The team designed, built, and tested a new experimental test setup to measure the flow distribution through the core of a compact fin heat exchanger supplied by Honeywell. Upon completion of the project, Honeywell will receive a full documentation and analysis of experimental results.

Irvine Ranch Water District Alternative SCADA Backup Methods for Reservoir Monitoring

Liaisons: Carl Spangenberg, Dave
Mazzarella
Advisor: Anthony Bright
Students: Sean Cramer (TL), Donya
Frank (F), Abram Kim,
Jed Harmsen (S), Vicky
Luyapan (S), Elizabeth Winton (F)

The Irvine Ranch Water District (IRWD) clinic team researched, tested, and implemented telemetry solutions for a Supervisory Control And Data Acquisition (SCADA) backup system used to monitor potable and reclaimed water reservoir levels. The team tested the reliability of two potential solutions, recommended the best design, and prepared documentation and cost estimates for a full-scale backup system.

Jet Propulsion Laboratory NASA

Antarctic Plateau Interferometer Concept Study

Liaisons: Mark Swain, Gautam Vasisht
Advisor: Pat Little
Students: Daniel Roche (TL), Kristina
Knepper, Michel Guillon, Eph
Lanford, Val Olsen (S)

The NASA JPL Polar Clinic team developed a design to "package" the Antarctic Plateau Interferometer in containers for transport to Dome C, Antarctica and support it during operation. To aid in this design, the team built and deployed an instrument package on the journey from Tasmania to Dome C this year which took measurements of acceleration loads. An isolation design for the optics truss and optical table system is proposed based on this data.

Lawrence Livermore National Laboratory Hydrogen Embrittlement of Wires in a Neutron Time Projection Chamber

Liaisons: Adam Bernstein, Leslie J.
Rosenberg
Advisor: Joseph King
Students: Tim Smith (TL), Zach Burstein,
Jim Castelaz, Jamie Kunkle,
Sarah Thomson (S)

The Lawrence Livermore National Laboratory has asked the team to evaluate the effects of a hydrogen environment on the strength and surface characteristics of wires used in a neutron Time Projection Chamber. The team designed a system to simulate the environment of an nTPC and characterized the effects of hydrogen embrittlement on very small diameter stainless steel, tungsten, and platinum wires.

Lockheed Martin Advanced Technology Center Creating a Computer-Controlled Active Tracking Heliostat

Liaisons: Kenneth Lorell '65, Mons
Morrison '85/87
Advisor: Erik Spjut
Students: Gabriel Takacs (TL), Lindsay
Allen, Sheldon Logan (S), Peter
Paras (F), Ruka Sakurai (S), Steven
Santana (F), Josh Slater (S)

The Lockheed Martin Solar Astrophysics Lab develops space-borne instruments that must be tested prior to use. The testing is performed in the lab using a stationary image of the sun. The team has designed, built, and tested a computer-controlled, active-tracking heliostat that can stabilize an image of the sun to within one arc-second and allow controlled slewing and offset. Additionally, the team has designed an enclosure to protect the heliostat once it is installed.

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

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“(PM)” Indicates Project Manager.

Los Alamos National Laboratory *Variable Pulsed Laser Delay Line for Flash Photography of Mesoscopic Spatial Dynamics*

Liaisons: Aaron Koskelo, Sam Clego
Advisor: Lori Bassman
Students: Elliott Temkin (TL), Sara Al-Beaini (F), Dustin Brekke (F), Eric Flynn, Tyler Jank (S), Nate Yoder (S)

Los Alamos National Laboratory would like to use flash photography to study material fracture at a microscopic spatial and temporal scale. This project has developed part of the system that will be used to conduct this research. The team designed, built, and tested a variable optical delay line capable of splitting a laser pulse in two, delaying one portion of the beam a user-specified amount of time, and then exiting this delayed pulse collinearly with the undelayed pulse.

Medtronic MiniMed *Occlusion Detection Algorithm Development in Insulin Pumps*

Liaisons: Rick Bente '04, Ian Hanson
Advisor: Joseph King
Students: Kevin Alley (TL), Robert Chambers (F), Galen Chui, Daniel Gruver, Faye Massen (S), Garry Newland (F)

Medtronic MiniMed produces insulin pumps for diabetics. This Clinic team is developing an algorithm to reduce the time it takes for the pump to detect a blockage in the delivery system. The Clinic team is also developing an analytical model of the pump system to aid Medtronic in developing future improvements to the pump.

Northrop Grumman Navigation Systems

External Fiber Optic Modulator

Liaison: David Hall
Advisor: Erik Spjut
Students: Nathan Mitchell (TL), Glenn Hudson, Kyle Kelley, Colin Marsh

Fiber optic acoustic systems at Northrop Grumman Navigation Systems utilize a phase generated carrier architecture. The source laser needs to be modulated externally with a carrier frequency of 25 kHz. Northrop Grumman has fabricated a device consisting of a fiberwrapped piezoelectric cylinder. The team has produced a similar system and characterized its performance at 25 kHz.

Northrop Grumman Space Technology

Passive Millimeter Wave Lens Testing Automation

Liaisons: Larry Yujiri, Erin Englert
Advisor: Ruye Wang
Students: Jack F. Shepherd III (TL), Benjamin Howard (S), Eddie Huang, Steve Lin (F), Joshua Webb

The main goal of the project is to analyze millimeter wave imaging lenses delivered by Northrop Grumman Space Technologies (NGST). This analysis will focus on capturing the point spread function (PSF) of the lenses using radiation around 89GHz. Furthermore, the team is tasked with designing and implementing the automation for this lens characterization process.

Oregon Medical Laser Center *Optical Tumor Location Device*

Liaison: Kenton Gregory M.D.
Advisor: Elizabeth Orwin '95
Students: Mark Locascio (TL), Sara Adelman (F), Jeff Gabster, Teresa Pineda (F), Madineh Sedigh-Sarvestani, Philip Tam (S), Lily Tian (S)

The goal of this project is to design a minimally invasive illumination device and power system capable of emitting a detectable signal. The device would be used as a surgical aid to locate cancerous tissue in the breast. The device would be inserted into the tumor before surgery, and then used during the procedure to guide the surgeon to the cancer site.

QUALCOMM

ZigBee Digital Modem Suitable for Cellular Phone Platform

Liaison: Kenneth Easton
Advisor: Sarah Harris
Students: Karen Lee (TL), Nicole Kang, Gabriel Kwofie, Tommy Leung, Kenneth Maples (S), Jack Zheng (F)

ZigBee is an emerging wireless standard focused on lightweight, low cost, and low power networking of electronics. Integrating ZigBee into the cellular phone platform allows the phone to act as a Personal Environment Device, letting the owner control close range electronic items such as light switches, vacuum cleaners, and thermostats. The team designed and tested a Zigbee compliant baseband digital modem suitable for integration into QUALCOMM's mobile cell phone ASIC designs.

Raytheon Space and Airborne Systems *Hyperspectral Image Data Processing Algorithms: Developing a Characterization Process*

Liaison: Thomas G. Chrien
Advisor: Ruye Wang
Students: John Silny (TL), Mary Chen (F), Kevin Chu, Eugene Hsueh (F), Raymond Ryckman (S), Daniel Woo

Hyperspectral image data processing uses a wide-range of wavelength spectra to identify targets within an image. The goal of this project is to explore the characteristics of processing algorithms. The key components of the project are the development of a set of metrics to determine the success and failure rates of an algorithm, the creation of tools to optimize performance and the presentation of the results of applying the metrics and tools to a test process.

Sandia National Laboratories *Augmented HVAC Sensors for Near-Real-Time Modeling of Dispersed Airborne Materials in Buildings*

Liaisons: Marvin Larsen, Richard Griffith
Advisor: Mary Cardenas
Students: Robert Krohn (TL), Alex Cohan, Justin Kauwale (F), Catherine Meyers (F), Jennifer Shockro (S), Jay Wright (S)

The threat of a contamination event in a building dispersing air through the heating and ventilation system has recently become a major concern to national security. The fate and transport of contaminants through a local building were modeled using CONTAM software. In order to accurately simulate contaminant flow, the standard HVAC system was augmented with additional flow sensors. The model was then validated through a series of on-site tracer gas releases.

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“(S)” Spring Semester.

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Sierra Wireless America, Inc.

Ethernet - to - USB Bridge

Liaison: Jean Philippe Kielsznia
Advisor: David Money Harris
Students: Daniel Chan (TL), Kevin Lloyd,
Daniel Rinzier, Rajdeep Roy (S),
Max Yi

Sierra Wireless provides laptop cards for high speed Internet access over Verizon's cellular network. These wireless cards require special driver software to be installed. The team has designed, built and demonstrated a small form factor bridge that connects any PC with Ethernet to the Verizon wireless network without special drivers.

Space Systems/Loral

Design and Vibration Characterization of a Passively Damped Satellite Bracket

Liaison: James Bockholt
Advisor: Ziyad Duron '81
Students: David Lipke (TL), Mark Brenneman (S), Chad Foerster, Jeffrey Lin, Arran McNabb (F), Gwen Yoshinaga

An antenna bracket currently in use on Space Systems/Loral's (SS/L) satellites is manufactured out of lightweight, but expensive carbon fiber composites. SS/L has charged the team with the redesign of the bracket in order to reduce the overall manufacturing and launch costs. The bracket must not exceed two pounds, and cannot exhibit a response greater than 25g's at any frequency below 100Hz. Bracket and passive damping designs were numerically modeled and vibration tested to meet specifications.

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

UVP, Inc.

Uniform Illumination for Fluorescent In Vivo Imaging

Liaisons: Sean Gallagher, Darius Kelly,
Colin Jemmott '04
Advisors: Qimin Yang, Deb Chakravarti
(KGI)
Students: Alyssa Caridis (TL), Stephanie Bohnert (S), Ekaterina Kniazeva, Erika Palmer (S), Laura Moyer (F), Jeremy Bolton (KGI), Linda Chen (KGI)

In order to improve the accuracy and effectiveness of live animal in vivo fluorescent imaging, UVP tasked a team of Harvey Mudd College and Keck Graduate Institute students to design, simulate, and test innovative imaging systems to achieve unparalleled illumination uniformity over five degrees of freedom. Uniform lighting is needed for quantitative analysis of in vivo images, which are used for cancer and disease research. Additionally, the team developed novel methodologies for measuring lighting uniformity.

MATHEMATICS CLINIC

Applied Biosystems

Automated Analysis of Gene Expression Data

Liaisons: Kenneth Livak '74,
Mark Wechser
Advisor: Henry Krieger
Students: Kevin Krogh (PM), Jefferey Brenion, Theresa Poindexter, Ryan Riegel

Analysis of gene expression data can help identify genes that reliably classify patients into groups corresponding to disease variants. This analysis can be difficult for researchers not formally trained in statistics. We describe our work toward the development of an algorithm that automates this analysis. The team explored methods such as principal component analysis, discriminant analysis, and the use of ratios of gene expression levels.

HP Labs

Analyzing and Correcting Printer Drift

Liaisons: John Meyer, Gary Dispoto
Advisor: Weiqing Gu
Students: Jeffrey Hellrung (PM), Brianne Boatman, Durban Frazer, Katie Lewis

In color printing, a lookup table (LUT) is a mapping from a computer's color space to the ink combinations required to print these colors. An LUT will drift over time due to a variety of factors including mechanical and environmental changes, resulting in an undesirable change in the printed results. Currently, constructing a new LUT is a time consuming process. This project focused on developing a quicker method to recalibrate a printer when drift occurs.

PHYSICS CLINIC

Sandia National Laboratories

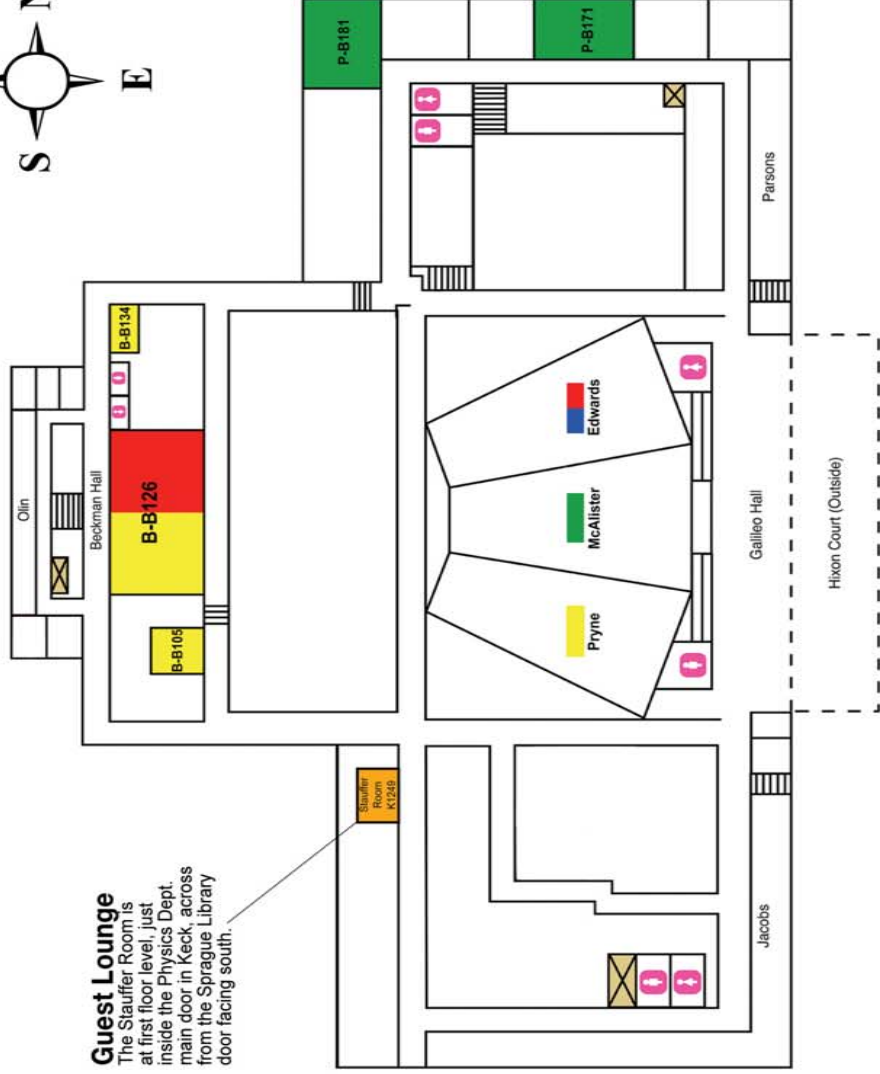
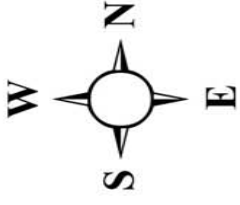
Optical Characterization of Coated Soot Aerosols or Flames and Lasers

Liaisons: Hope Michelsen,
Andrew McIlroy '85
Advisor: Peter Saeta
Students: Patrick Hopper (PM), Brendan Haberle, Matt Johnson, Julie Wortman, Mark Dansson, Tavi Semonin

The optical properties of coated soot aerosols produce the greatest uncertainty in climate change models. This project aims to measure the scattering and absorption of light by sub-micron sized soot particles similar to those produced in diesel exhaust. Total absorption and scattering cross sections of 635-nm laser light are measured using cavity-ringdown and angle-resolved scattering techniques. Soot particles are created in situ by partially combusting ethylene and coated with a volatile organic compound.

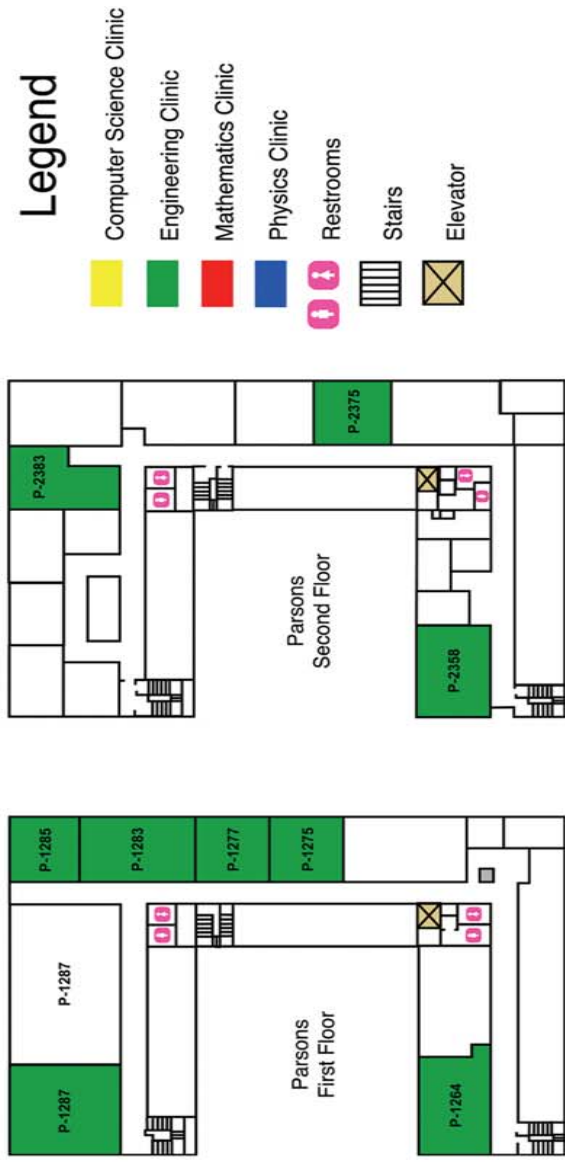
* **“(TL)” Indicates Team Leader.**
“(PM)” Indicates Project Manager.

Projects Day Directory 2005



Guest Lounge
The Stauffer Room is at first floor level, just inside the Physics Dept. main door in Keck, across from the Sprague Library door facing south.

Basement Floor of Beckman, Galileo & Parsons



Legend

- Computer Science Clinic
- Engineering Clinic
- Mathematics Clinic
- Physics Clinic
- Restrooms
- Stairs
- Elevator

First and Second Floors of Parsons