

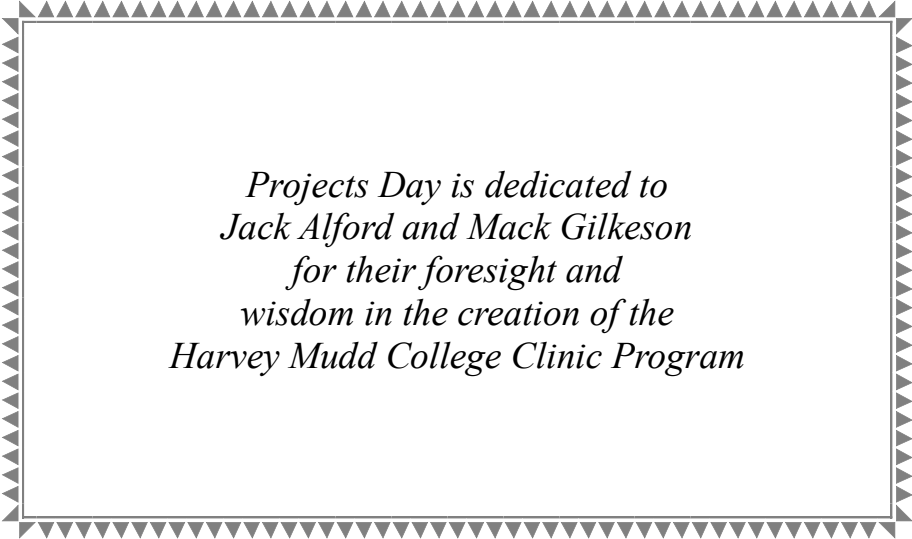
Projects Day 2016

**Celebrating 53 Years of Excellence:
1963-2016**

**Tuesday, May 3
10:30 a.m. – 6 p.m.**



Clinic Program



*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*

46th Annual Projects Day

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

Geoff Kuening, Director
Computer Science Clinic

David Money Harris, Director
Engineering Clinic

Kash Gokli, Associate Director
Engineering Clinic

Patrick Little, Director
Global Clinic

Weiqing Gu, Director
Mathematics Clinic

Peter Saeta, Director
Physics Clinic

Harvey Mudd College
PROJECTS DAY
May 3, 2016

Program

- 10:30 a.m. Registration and Poster Viewing Platt Campus Center
- 1:00 p.m. General Session Shanahan Center 1430

Welcome - Maria Klawe, President

Remarks - David Money Harris, Director, Engineering Clinic

Milestone Awards - Jeffrey Groves, Dean of the Faculty

Recipients:

Apatite to Zircon, Inc./BiMBY Power Company, LLC

BD

City of Hope

Intel Corporation

Laserfiche

Lawrence Livermore National Laboratory

- 1:30 - 3:00 p.m. Project Presentations See Schedule
- 3:00 - 3:30 p.m. Break Shanahan Center:
1st Floor North Terrace &
Thomas Garrett Plaza
- 3:30 - 5:00 p.m. Project Presentations See Schedule
- 5:15 - 6:00 p.m. Poster Reception Platt Campus Center
Guests, Faculty, and Students

Schedule of Presentations

Project	Time						Location
	1:30	2:00	2:30	3:30	4:00	4:30	
COMPUTER SCIENCE CLINIC							
American Express <i>Predicting Customer Behavior from Credit Card Transactions</i>	X		X			X	2407
Gimbal <i>Indoor Mapping with Bluetooth Beacons</i>		X	X			X	3425
Intel Corporation <i>Location-Aware Data Sharing Between Devices</i>	X	X		X			B-450
Laserfiche <i>Simple Real-Time Data Analysis System</i>			X	X		X	3481
Lawrence Livermore National Laboratory <i>Understanding Detailed Memory Performance Data</i>	X				X	X	3465
Microsoft-Turn 10 Studios <i>Procedural Dynamic HDR Sky Rendering in Video Games</i>	X	X				X	B-470
MITRE Corporation <i>Digital Aging</i>	X		X		X		2475
Sandia National Laboratories <i>Advanced Toolkit for Adaptive Particle Simulations</i>		X	X		X		3461
Steelcase, Inc. <i>Classifying Wood Veneer</i>			X		X	X	B-450
Time, Inc. <i>Image Fingerprinting</i>		X		X	X		2407
Webroot, Inc. <i>Social Reputation on Twitter</i>		X		X		X	2475
Yelp, Inc. <i>Empowering Information Discovery: Extracting Meaning from Yelp Reviews</i>	X	X				X	2461
Zendesk, Inc. <i>Zenscript</i>			X	X	X		B-470
COMPUTER SCIENCE/ ENGINEERING CLINIC							
The Aerospace Corporation <i>Innovative Graphics and Input Enhancements for the Satellite Orbit Analysis Program (SOAP)</i>	X	X			X		3481
Oakley <i>Project CharlieMike</i>			X	X	X		2461
Project Spock <i>Tracking Activity and Motion to Improve Success Likelihood of Liver Transplant</i>		X		X		X	3485

Building Codes:

SHAN = Shanahan Center for Teaching and Learning Building

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

Project	Time						Location
	1:30	2:00	2:30	3:30	4:00	4:30	
TAG, LLC <i>Automated Examination of Collectibles</i>	X	X				X	B-454
Teledyne Controls <i>Flight Artificial Intelligent Router (FLAIR)</i>	X	X		X			2454
COMPUTER SCIENCE/PHYSICS CLINIC							
Lawrence Livermore National Laboratory <i>Atomistic Simulations of White Dwarf Dynamics</i>		X	X	X			3465
ENGINEERING CLINIC							
Amazon Lab126 <i>Automated Collection of Speech in Noise</i>	X		X		X		1480
AT&T Entertainment Group <i>Antenna Installation Improvements</i>		X			X	X	2465
BD <i>Redesigning the Secondary Infusion</i>	X			X		X	2425
BiMBy Power Company, LLC <i>Big Mass Battery: Engineering Challenges and Feasibility</i>	X		X	X			2465
City of Hope <i>Novel System for Femoral Reconstruction Surgery</i>	X			X	X		2421
City of Hope <i>Portable Surgical Retractor Attachments</i>		X	X			X	2421
Kinohi Institute <i>Spatial Heterodyne Raman Spectrometry</i>	X				X	X	2440
Mission Rubber, Inc. <i>Rubber Molding Process Energy Reduction</i>		X		X	X		3421
MIT Lincoln Laboratory <i>Wireless Coordination Testbed</i>	X		X			X	3421
Niagara Bottling Company, LLC <i>Thickness Measurement of Thin-Film Polymer Containers</i>	X	X			X		2460
Niagara Bottling Company, LLC <i>Zero-Cost Changeover</i>			X	X		X	2460
Northrop Grumman Corporation <i>Automotive Radar</i>	X	X	X				B-442
Project Magneto <i>Broad-Spectrum Electromagnetic Shielding in Consumer Electronics</i>	X		X		X		3485
Proteus Digital Health <i>Hydration Monitoring Using Impedance Techniques</i>		X		X		X	1480
Regenesis Biomedical Inc. <i>Data Acquisition and Wireless Communication System for Postoperative Pain Treatment Device</i>		X	X		X		2425
SpaceX <i>Improved Leak Detection</i>	X	X			X		B-460
Whistle Labs, Inc. <i>Wearable Ambient Temperature Monitoring</i>			X	X		X	B-460
Wildlands Conservancy <i>Micro-Hydroelectric System</i>				X	X	X	B-442

Project	Time						Location
	1:30	2:00	2:30	3:30	4:00	4:30	
ENGINEERING/PHYSICS CLINIC							
Sandia National Laboratories	X			X		X	3461
<i>Measuring the Permittivity of Barium Titanate Nanoparticles in a Matrix-Free Composite</i>							
ENGINEERING/MATHEMATICS CLINIC							
Pharmavite, LLC		X	X	X			2440
<i>Finite Scheduling</i>							
GLOBAL CLINIC							
RainCatcher, Inc.	X			X	X		3425
<i>Low-Cost, Monitoring of Remote Rainwater Catchment Tanks</i>							
MATHEMATICS CLINIC							
EDR	X	X	X				2450
<i>Algorithms for Property Search and Identification</i>							
HRL Laboratories	X		X	X			B-480
<i>Analysis of Quantum Communication Network Protocols</i>							
Microsoft Corporation				X	X	X	2450
<i>Anomaly Detection for Live Site Incident Detection</i>							
NOAA-Alaska Fisheries		X			X	X	B-480
<i>Parameter Estimation on Marine Biological Models</i>							

2015/2016 Clinic Sponsors

Computer Science

American Express
Gimbal
Intel Corporation
Laserfiche
Lawrence Livermore National
Laboratory
Microsoft Turn 10 Studios
MITRE Corporation
Sandia National Laboratories
Steelcase
Time, Inc.
Webroot, Inc.
Yelp, Inc.
Zendesk, Inc.

Computer Science/Engineering

The Aerospace Corporation
Oakley
Project Spock
TAG, LLC
Teledyne Controls

Computer Science/Physics

Lawrence Livermore National
Laboratory

Engineering

Amazon Lab126
AT&T Entertainment Group
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Mission Rubber Company
MIT Lincoln Laboratory

Niagara Bottling Company, LLC
Northrop Grumman Corporation
Project Magneto
Proteus Digital Health
Regenesis Biomedical
SpaceX
Whistle
Wildlands Conservancy

Engineering/Mathematics

Pharmavite, LLC

Engineering/Physics

Sandia National Laboratories

Global Clinic

RainCatcher, Inc.

Mathematics

EDR
HRL Laboratories
Microsoft
NOAA-Alaska Fisheries

CLINIC ADVISORY COMMITTEE OF HARVEY MUDD COLLEGE

Industry Members:

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Joseph Betser, The Aerospace Corporation
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Bob Butterfield, BD (Becton, Dickinson and Company)
Carl Carrera Jr. '75/76, The Boeing Company (Retired)
Frances Ferris '80, The Boeing Company (Retired)
David Lesyna, Optivus Proton Thereapy, Inc.
John Livingston, Tandem Diabetes Care (Retired)
John McNeil '89, John McNeil & Co., Inc.
Roy Park '02, Raytheon Company
Elly Schofield '13, Harvey Mudd College
Craig Snow, Raytheon Space and Airborne Systems

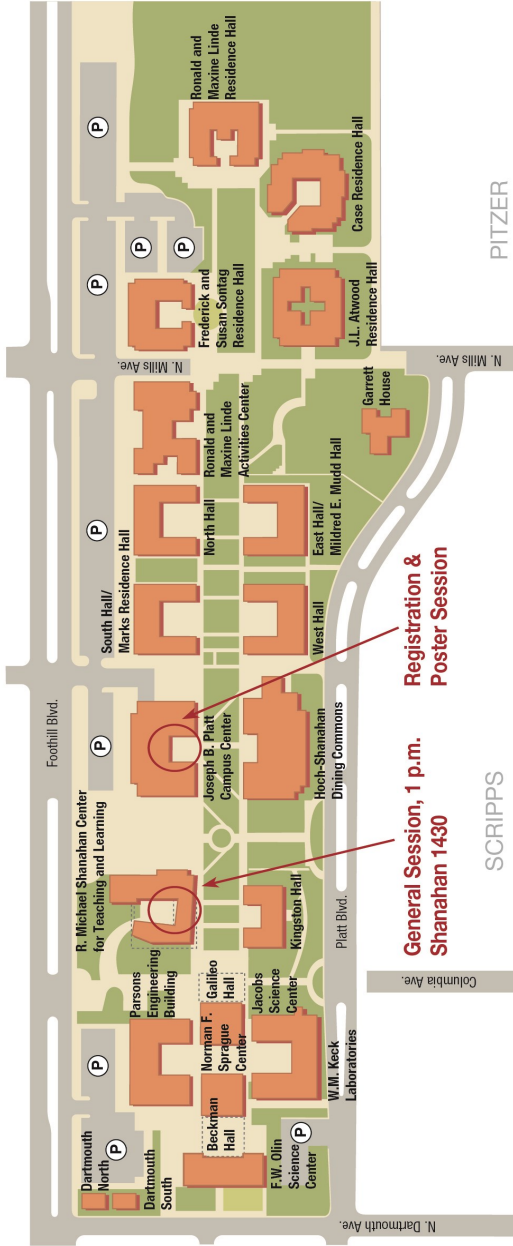
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Maria Klawe, President
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Andrew Dorantes, VP for Administration & Finance/Treasurer
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David Money Harris, Director, Engineering Clinic
Kash Gokli, Associate Director, Engineering Clinic
Patrick Little, Director, Global Clinic
Weiqing Gu, Director, Mathematics Clinic
Peter Saeta, Director, Physics Clinic

Personalized Projects Day Schedule

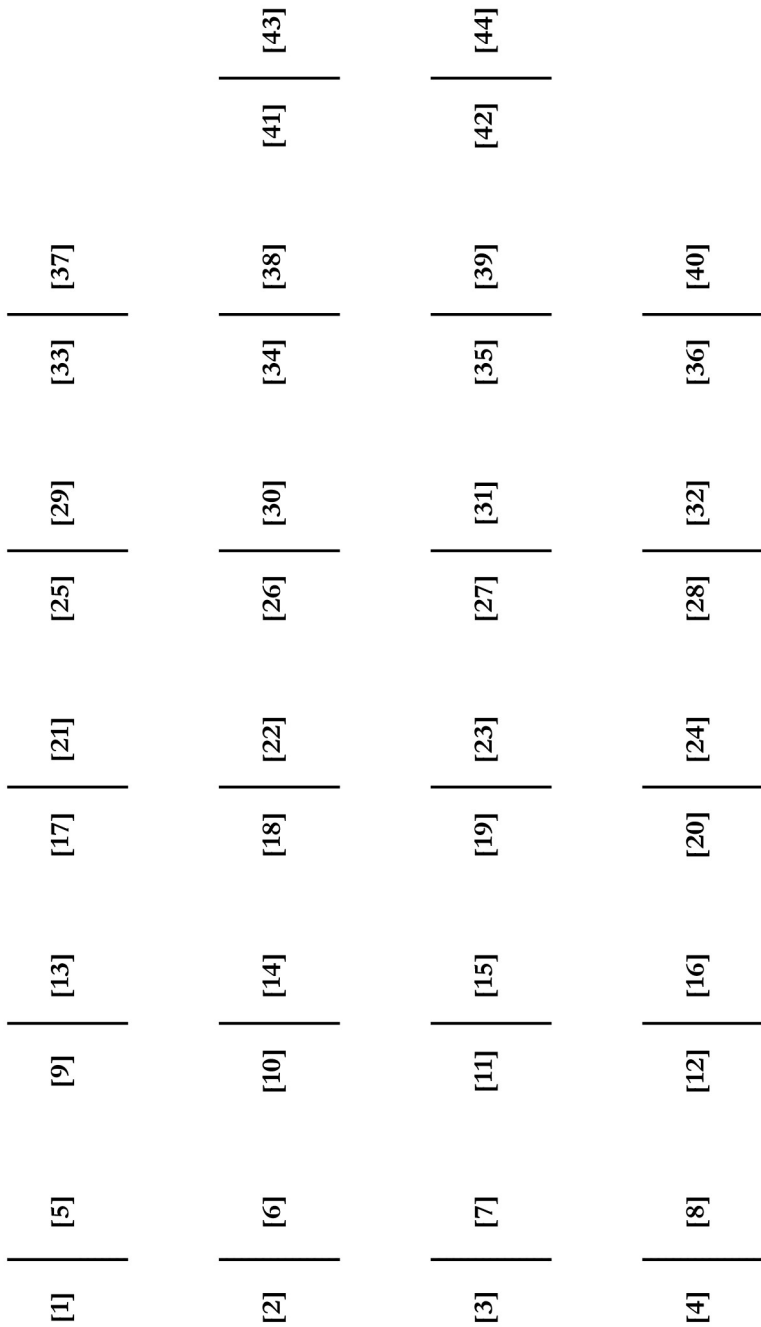
Please fill in the empty slots below with the presentations you would like to attend.

Time	Event	Location
10:30 a.m.	Registration and Poster Viewing	Platt Campus Center
1:00 p.m.	General Session	Shanahan Center 1430
1:30 p.m.		
2:00 p.m.		
2:30 p.m.		
3:00 p.m. - 3:30 p.m.	Break	Shanahan Center Thomas Garrett Plaza
3:30 p.m.		
4:00 p.m.		
4:30 p.m.		
5:15 p.m. - 6:00 p.m.	Poster Reception	Platt Campus Center



Ⓟ HMC Community Parking Only | Public parking is available on Foothill Boulevard and also on Platt Boulevard.

Poster Session Layout Projects Day



Key to Poster Session Layout

1. The Aerospace Corporation
2. Amazon Lab126
3. American Express
4. AT&T Entertainment Group
5. BD
6. BiMBy Power Company, LLC
7. City of Hope - Nail
8. City of Hope - Retractor
9. EDR
10. Gimbal
11. HRL Laboratories
12. Intel Corporation
13. Kinohi Institute
14. Laserfiche
15. Lawrence Livermore National Laboratory (CS/PHY)
16. Lawrence Livermore National Laboratory - Memory (CS)
17. Microsoft Corporation
18. Microsoft Turn 10 Studios
19. Mission Rubber, Inc.
20. MIT Lincoln Laboratory
21. MITRE Corporation
22. Niagara Bottling Company - Measurement
23. Niagara Bottling Company - Zero
24. NOAA - Alaska Fisheries
25. Northrop Grumman Corporation
26. Oakley
27. Pharmavite, LLC
28. Project Magneto
29. Project Spock
30. Proteus Digital Health
31. RainCatcher, Inc.
32. Regenesys Biomedical, Inc.
33. Sandia National Laboratories (CS)
34. Sandia National Laboratories (ENG/PHY)
35. SpaceX
36. Steelcase, Inc.
37. TAG, LLC
38. Teledyne Controls
39. Time, Inc.
40. Webroot, Inc.
41. Whistle Labs, Inc.
42. Wildlands Conservancy
43. Yelp, Inc.
44. Zendesk, Inc.

COMPUTER SCIENCE CLINIC

American Express

Predicting Customer Behavior from Credit Card Transactions

Liaisons: Kairavi Chahal, Terrence Fischer,
Anthony Mavromatis, Brett Vintch
Advisor: Yi-Chieh (Jessica) Wu
Students: November Baez (PM-S),
Kelly Lee (PM-F), Maury Quijada,
Sarah Trisorus, Paula Yuan

American Express is a global financial services company with over a trillion dollars in card member spend. In order to improve the experience of American Express card members and merchants, the Clinic project uses this spend data to predict future customer transactions at specific merchants. To achieve this, the project documents and designs a framework using various machine learning models that yield accurate transactional predictions for American Express card members and merchants.

Gimbal

Indoor Mapping with Bluetooth Beacons

Liaisons: Chas Wurster '97, Mike Barboni
Advisor: Melissa O'Neill
Students: Kaitlyn Anderson (PM-S), Louie Brann,
Paige Garratt (PM-F), Cyrus Huang

Gimbal is the producer of the most widely deployed Bluetooth® Smart beacons in the world. With this technology, Gimbal provides a solution that allows users to receive relevant location-based content, directly to their mobile phones. However, the beacons need to be placed properly in order for them to be effective. We developed an iOS application that uses the phone's sensors as well as signals from the beacons to create an accurate, interactive map of the installed constellation of beacons.

Intel Corporation

Location-Aware Data Sharing Between Devices

Liaisons: Ravishankar Iyer, Omesh Tickoo,
David Florey, Doye Emelue
Advisor: Robert Keller
Students: Emma Meersman (PM-S),
Anne Christy (PM-Fall), Daniel Cogan,
Hugo Ho

We designed an approach to using location-based data and querying as a means of exploring new ways for users and devices to interact over the Internet. We created an application programming interface (API) that provides convenient tools for developers to integrate location-based communication in a wide range of applications. We developed applications on Android phones that use our API to demonstrate and validate our approach.

Laserfiche

Simple Real-Time Data Analysis System

Liaisons: Karl Chan '89, Kurt Rapelje,
Edward Heaney '04, Tessa Adair '14
Advisor: Beth Trushkowsky
Students: Rachelle Holmgren (PM-S),
Jean Sung (PM-F), Drew Schmitt,
Amit Maor

Laserfiche provides its customers with a system to create, execute, and report on business processes. The goal of our project was to create a data analysis system that provides each customer with insights they could use to improve their processes. Our team researched and tested various methods for analyzing business process data that would be beneficial to the wide range of Laserfiche customers.

Lawrence Livermore National Laboratory

Understanding Detailed Memory Performance Data

Liaisons: Todd Gamblin, Alfredo Gimenez,
David Beckingsale

Advisor: Chris Stone

Students: Andrew Fishberg (PM), Paul Dapolito,
Samuel Jackson, Xiaotian Wang

Mitos and MemAxes, a pair of memory analysis and visualization tools developed by Lawrence Livermore National Laboratory's Scalability Team, aid supercomputer users in diagnosing high performance computing (HPC) speed bottlenecks. The LLNL Memory Clinic Team has expanded these tools to be more accessible and powerful for users. Specifically, the team has augmented widely used physics mesh simulation programs to provide detailed Mitos traces and explored machine learning techniques for automatically diagnosing performance problems.

Microsoft Turn10 Studios

Procedural Dynamic HDR Sky Rendering in Video Games

Liaisons: Daniel Adent '86/87, Chris Tector,
Colin Reed

Advisor: Elizabeth Sweedyk

Students: Melissa Galonsky (PM-S),
Karen Huddleston (PM-F),
Anna Pinson, Alejandro Mendoza

Skies form an important part of any outdoor environment. Turn 10's current methods have to make tradeoffs between realism, disk space usage, and dynamically choosing the sun and cloud positions. The Turn 10 clinic team aims to solve these problems by procedurally generating realistic skies with the sun position and clouds asked for by the user.

MITRE Corporation

Digital Aging

Liaisons: Nick Orlans, Sarah Doyle, Jay Doyle,
Adam Day

Advisor: Lisa Kaczmarczyk

Students: Vincent Fiorentini (PM-S), Hana Kim,
Josh Petrack, Hannah Young (PM-F)

Identification of missing persons becomes more difficult over time as the person ages. To address this challenge, this Clinic project aims to digitally age a face image of a person, building off of existing image processing techniques. The team has created a script interfacing with Adobe Photoshop to simulate the effects of aging on face images, focusing in particular on young subjects to better help identify missing children when their images are presented to automated tools and human observers.

Sandia National Laboratories

Advanced Toolkit for Adaptive Particle Simulations

Liaisons: Dr. Jeremy Templeton,
Dr. Karla Morris,
Dr. Lindsay Erickson '04

Advisor: Jeff Amelang

Students: Justin Lee (PM), Daniel Bork,
Maxfield Comstock, Matthew Valentine

The objective of the clinic project is to develop an alternative to a Voronoi tessellation package called voro++ to be used for mesh-free particle methods calculations. This includes efficiently matching existing functionality for identifying neighbors and calculating particle volumes. On top of this, the project will be able to support group specifications to be able to run calculations on subsets of the particles. The tessellator will interface with the mesh-free particle methods package created by Sandia called MOAB.

Steelcase

Classifying Wood Veneer

Liaisons: James Huey, Ed Vander Bilt, Joe Noto,
Mark Schild, Steve Royce,
Vince Palazzolo
Advisor: Jim Boerkoel
Students: Jennifer Rogers (PM-S),
Perry Holen (PM-F), Jenner Felton,
Rachel Wilson

Steelcase is the world's leading manufacturer of high-quality office furniture, some of which is finished with thin slices of wood, called veneer. Since wood is a natural product, this veneer may look significantly different from one log to the next. Our goal is to maximize customer satisfaction by minimizing the perceived variation among the pieces of veneer in furniture. To accomplish this goal, we built a model that sorts veneer into categories based on its color and grain characteristics.

Time, Inc.

Image Fingerprinting

Liaisons: Eric Schoonover, Derek Baron
Advisor: Yi-Chieh (Jessica) Wu
Students: Sarah Gilkinson (PM-S),
Hannah Turk (PM-F), Jonathan Finnell,
Zehao (Michael) Zhang

Time, Inc. uses millions of images for its various brand websites. It is important for Time, Inc. to maximize reuse of content across brands while preventing perceived duplication and to track usage of images from various sources even after images have been resized, compressed, or otherwise altered. Using content-based image hashing techniques, our team has created a system to identify similar images even after they have gone through editing processes.

Webroot, Inc.

Social Reputation on Twitter

Liaisons: Hal Lonas, Trung Tran
Advisor: Lisa Kaczmarczyk
Students: Ruoxi Lu (PM), Brenda Garcia,
Yuwei He, Kevin Wynn

The goal for the Webroot 2015-16 Clinic project is to increase the awareness of the risks users face when choosing to participate in various social media networks. The team has developed a social network reputation model, which will be available in the form of an Android application, to inform users of these risks. For this project, Twitter is the primary social network platform used for an analysis of the wide range of possible malicious content such as viruses and spam.

Yelp, Inc.

Empowering Information Discovery: Extracting Meaning from Yelp Reviews

Liaisons: Colin Pollock, Mohini Thakkar,
Phillip Zukin
Advisor: Julie Medero
Students: Chloé Calvarin (PM-F),
Dani Demas (PM-S), Josh Kutsko,
Won Kyoung Park, James Saindon

The goal of this project is to explore new ways in which Yelp can help its users glean information from an overwhelming number of reviews for a business. To that end, we have implemented a system that automatically identifies important characteristics of a business and the reviewers' opinions of these characteristics. With this information, we group these characteristics into high-level categories so that users can quickly find the information they're looking for.

Zendesk

Zenscript

Liaisons: Gary Grossman, Steven Yan '02
Advisor: Ben Wiedermann
Students: Alexander Putman (PM-S), Mai Ho,
Shannon Lin (PM-F),
Kevin McSwiggen

The Zendesk clinic team is developing a domain specific language to suit the needs of Zendesk's largest customers. The language is intended to provide a way to create more succinct and powerful business rules for defining customer support workflow than currently provided in Zendesk. The team's goal is to make these business rules powerful in order to reduce their overall quantity, improving the maintainability of the customer's system.

COMPUTER SCIENCE/ ENGINEERING CLINIC

The Aerospace Corporation Innovative Graphics and Input Enhancements for the Satellite Orbit Analysis Program (SOAP)

Liaisons: Joe Betser, John Coggi, Dave Stodden
Advisor: Geoff Kuenning
Students: Zakkai Davidson (PM), Eric Caldwell,
Christian Guerrero, Fabiha Hannan,
Emily Stansbury

The Aerospace Corporation is a Federally Funded Research and Development Center (FFRDC) that provides its Satellite Orbit Analysis Program (SOAP) to a variety of national security and space customers. This clinic project encapsulated a number of 3D rendering techniques in a digital globe framework that can be readily adapted for incorporation into SOAP and/or other OpenGL-based graphics software. The supported effects include real time weather data acquisition and visualization, terrain shadowing, smoke simulation, improved trajectory drawing, and realistic night and day transition.

Oakley

Project CharlieMike

Liaisons: Jason Belbey, Cameron Burns,
Benjamin Meunier
Advisor: Ran Libeskind-Hadas
Students: Oliver Seifert (PM-S),
Marina Haukness (PM-F),
Bryan Mehall, Ashuka Xue,
Hannah Rose

Part of Oakley's design process requires the alignment of pairs of 3D scans of a human face and detection of key points of interest in these scans. Until now, this process was done manually and took approximately an hour for one pair of scans. The Oakley clinic team has developed software that automates the alignment and key point detection processes. This software substantially speeds up these tasks and provides more accurate results than were previously attainable.

Project Spock

Tracking Activity and Motion to Improve Success Likelihood of Liver Transplant

Liaison: N/A
Advisor: David Harris
Students: Akhil Bagaria (TL- S),
Samantha Echevarria,
Minhtrang Vy (TL- F), Erin Paeng (S),
Vaibhav Viswanathan (S),
Charlotte Robinson (F)

Several factors drive liver transplant success, including a patient's physical activity both pre- and post-operation, and the treatment of subsequent neurological complications that manifest as hand tremors. The Project Spock team is developing both an app for a wearable device and a secure web app that will allow physicians to track physical activity and detect the onset of hand tremors in their patients. These apps will help physicians monitor patients as they prepare for and recover from a liver transplant.

TAG, LLC

Automated Examination of Collectibles

Liaisons: Steve Kass, Ed Korbel, Scot Maxwell,
Joseph King

Advisor: Zachary Dodds

Students: Kate Aplin, Hayden Blauzvern (PM-S),
Megan Shao (PM-F), Ben Teng,
Avi Thaker

Often, the examination of objects where condition is important do not use technology to its full capacity. Currently, these examinations are done by hand and by eye. Though traditional, this process is more costly, inconsistent, and generally not reproducible. To solve this problem, our team has investigated and prototyped an algorithmically driven processing system wherein specific criteria are examined using computer vision and machine learning resulting in precise, consistent and reproducible conclusions.

Teledyne Controls

Flight Artificial Intelligent Router (FLAIR)

Liaisons: Wolf Sonnenberg, Diana Mar '14,
Armen Babakanian, Matt Staker

Advisor: Anthony Bright

Students: Carson Witte (TL), Daniel Xie,
Jeongwoo Choi, John Park,
Thomas Legeais (EX)

Although many modern commercial aircraft are equipped with multiple off-aircraft communication links, in most cases a particular onboard system is limited to using one pre-assigned link. This inefficient method of aircraft-ground communication has led Teledyne Controls to seek a flexible air-ground communication management system that performs a rule-based smart router function to dynamically select the optimal link to be used for off-aircraft communication. An embedded software program, designed to interface with Teledyne's current products, was created to implement this important function.

COMPUTER SCIENCE/PHYSICS CLINIC

Lawrence Livermore National Laboratory

Atomistic Simulations of White Dwarf Dynamics

Liaisons: Jim Glosli, Michael Murillo,
Dave Richards '92

Advisor: Gregory Lyzenga

Students: Phillip Diffley (PM), Daniel Houck,
Lennart Rudolph, Skyler Williams

Lawrence Livermore National Laboratory (LLNL) wishes to better understand the liquid-crystal interface found in white dwarfs. Using LLNL's massively parallel molecular dynamics simulation code (ddcMD) along with their Blue Gene Q supercomputer, the HMC team will simulate a small region of the interface to shed light on impurity sedimentation and mixing.

ENGINEERING CLINIC

Amazon Lab126

Automated Collection of Speech in Noise

Liaisons: Philip Hilmes '98, Kenneth Hild

Advisor: Ruye Wang

Students: Sebastian Krupa (TL), Adam Schiller,
Orpheas Petroulas,
Thomas Berrueta (S), Joshua Lam (S),
Evan Kahn (S), Daniel Rodriguez (F)

The (Amazon) Lab126 clinic team was tasked with creating a set of automated test benches to allow greater reproducibility and ease of operation for testing the Alexa Voice Service. This consisted of a software component to automate the activation of various sound sources along with an automated positioning system which could move multiple devices around a room to test a variety of parameters. Furthermore, the team investigated the feasibility of replacing live speech with pre-recorded speech to further automate testing.

AT&T Entertainment Group ***Antenna Installation Improvements***

Liaisons: Terence Wu, Stephen Dulac
Advisor: Erik Spjut
Students: Ferrel Atkins (TL-S), Alex Rich (TL-F),
Tiancheng Yang, Patrick McKeen (S),
Kai Xu (S), Kathryn Jones (F),
Lydia Scharff (F)

The Harvey Mudd AT&T Entertainment Group clinic team has focused on improving antenna installation processes. In order to provide satellite television service, AT&T Entertainment Group must point an antenna, without any line of sight obstructions, at the company's satellites. The clinic team has created an application designed to determine the feasibility of placing an antenna without obstruction, shown that a smartphone magnetometer cannot track fine angle measurements of an antenna, and created a smartphone application to aid antenna pointing without fine adjustment knobs.

BD ***Redesigning the Secondary Infusion***

Liaison: Robert Butterfield
Advisor: Gordon Krauss
Students: Thendral Govindaraj (TL-S),
Samuel DeRose (TL-F), Arthur Chang,
Raul Sun Han, Deval Gupta (S),
Samantha Hoang (F),
Andrew Marino (F)

The BD/CareFusion Clinic team designed an intravenous infusion device that helps nurses deliver secondary-mode infusions with improved simplicity and reliability. The device achieves this by automating complex, non-intuitive manual operations. It will benefit hospitalized patients who receive intravenous medications.

BiMBy Power Company, LLC ***Big Mass Battery: Engineering Challenges and Feasibility***

Liaisons: Dr. Ray Donelick 'P15,
Dr. Greg Arehart
Advisor: Erik Spjut
Students: Caroline Nielsen (TL), Sammy Bor,
Jacob Higle-Ralbovsky, In Sung Song,
Fernando Salud (S), Ian Song (S),
Emily Beese (F), Daniel Nguyen (F)

Each year, hundreds of millions of tons of overburden and waste rock are moved by mining operations nationwide. The Big Mass Battery Clinic team is developing a method to take advantage of this unused mass to store power from renewable energy sources. The proposed device stores renewable energy as potential energy by elevating this mass when excess grid power is available and releases energy by lowering the mass when demand exceeds baseload capacity. The team has demonstrated the feasibility of this device and developed models to inform its implementation.

City of Hope ***Novel System for Femoral Reconstruction Surgery***

Liaisons: Dr. J. Dominic Femino,
Dr. George Calvert
Advisor: Gordon Krauss
Students: Sherman Lam (TL-F),
Sarah Nichols (TL-S), Matias Farfan,
Alana Chapko (F), David Tenorio (F),
Leonardo Huerta (S),
Emily Schooley (S),
Connor Stashko (S)

Metastatic tumors often weaken the bones of cancer patients. If a patient's femur breaks, they could lose mobility for the rest of their life. The current procedure to reinforce weakened femurs is not always effective. The team has designed, prototyped, and tested a set of devices that will improve the existing procedure. The devices include an improved tumor removal tool, a sophisticated cement applicator, and a redesigned femoral nail.

City of Hope

Portable Surgical Retractor Attachments

Liaisons: Dr. Sharon Clancy,
Dr. Christopher Chung,
Dr. Kurt Melstrom

Advisor: Nancy Lape

Students: Ana Villa (TL-S), Julie Chang (TL-F),
Amjad Al Smadi (EX),
Sarah Anderson (S),
Phuong Nguyen (S), Marisa Kager (F)

To improve surgery visibility and mobility, the City of Hope - Retractor 2015-2016 Clinic Team will design and prototype retractor attachments. Listed by priority level, the following attachment components will be developed: lighting, smoke evacuation, camera optics, and organ barrier. The components will be cordless, long lasting, sterilizable, and capable of maintaining a safe temperature to prevent injury to surgeons and patients.

Kinohi Institute

Spatial Heterodyne Raman Spectrometry

Liaison: M. C. Storrie-Lombardi, M.D. 'P13

Advisor: Philip Cha

Students: Kunal Menda (TL-S),
Apoorva Sharma (TL-F), Alex Alves,
Erica Martelly (S), Achintaya Bansal

The 2015-16 Kinohi Clinic Team is designing, building, and testing a device for capturing the Raman spectra of organic molecules using the Spatial Heterodyne Spectrometer optical design operating with near infrared excitation light. Using no moving parts, this novel approach to Raman spectrometry robustly allows for non-contact, non-destructive material identification. Such a spectrometer has promising applications in fields ranging from chemistry and molecular biology to astrophysics.

Mission Rubber Company

Rubber Molding Process Energy

Reduction

Liaisons: Donald Wrixon, Richard Getze

Advisor: Ziyad Duron

Students: Jessica Szejer (TL-S),
Daniel Lee (TL-F), Angela Ng,
Aman Fatehpuria (S), Cherie Ho (S),
Michael Chaffee (F), Ruth Sung (F)

Mission Rubber Company is a leading manufacturer of rubber-based products. The Harvey Mudd Mission Rubber Clinic Team is tasked with evaluating and reducing current energy usage in the manufacturing process. The preheat oven and the compression press have been identified as key areas for energy reduction. The team is developing industrial grade prototypes for compression press insulation and consulting with vendors on alternate preheat ovens.

MIT Lincoln Laboratory

Wireless Coordination Testbed

Liaisons: Bryan Teague '10,
Masato Kocberber '10,
Sarah Lichtman '14, Eric Storm '15

Advisor: Ziyad Duron

Students: Max Waugaman (TL), Jessica Iwamoto,
Jonathan Perez, Bonny Chen (S),
Joanna Ho (S), Jacob Nguyen (F)

Time synchronization is essential in telecommunication networks and a variety of other fields and applications. There a number of coordination architectures that are widely used to achieve time synchronization in a network. In this project, a model of clock synchronization and a wireless coordination testbed are built to compare the performance of synchronization architectures, algorithms, and hardware. The testbed measures, predicts, and compensates for timing offset and drift between spatially separated systems.

Niagara Bottling, LLC
***Thickness Measurement of Thin-Film
Polymer Containers***

Liaisons: Alexander Mouschovias, Jay Hanan
Advisor: Anthony Bright
Students: Jerry Hsiung (TL-S), Mo Zhao (TL-F),
Caitlyn Bonilla, Julie Baffard (EX),
Yi Yang (S), Yoo Jeong Shim (S),
Paige Rinnert (S),
Zane Bodenbender (F)

Niagara Bottling, LLC is the largest private label bottled water supplier in the U.S. The company closely monitors its bottles for structural integrity and cost.

The Niagara Measurement Clinic Team will design, build, and test a system that can detect changes in bottles being produced on the production line ensuring quality and throughput.

Niagara Bottling, LLC
Zero-Cost Changeover

Liaisons: Craig Young, Kartik Gurav,
Colin Cavanaugh, Daryl Anderson,
Michael White
Advisor: Kash Gokli
Students: Spenser Anderson (TL-S),
Tito Barina (TL-F), Aaron Rosen,
Faith Lemire-Baeten (F), Alexa Le (F),
Shaan Gareeb (S), Carmel Zhao (S),
Jose Orozco (S), Robert Cyprus (S)

When a manufacturing line stops making one product and starts producing a new product, the machines on the line must be modified or recalibrated in order to produce the new item, in a process called a changeover. Niagara Bottling, LCC has tasked the HMC team with reducing the cost of changeovers performed on one of the machines on their water-bottling lines.

Northrop Grumman Corporation
Automotive Radar

Liaisons: Michael Aung '01, Mike Leung '78,
Ron P. Smith
Advisor: Christopher Clark
Students: Amy (Man Wai) Ngai (TL-S),
Paul Jolly (TL-F), Sarah Paek,
Jerry Martinez, Paul Slaats (S),
Tae Ha "Jeff" Park (S),
Michael Reeve (F)

Automotive radar plays a major role in collision avoidance and cruise control. As radar systems become more prevalent, interference becomes a critical issue. The Harvey Mudd Clinic Team investigated the effects of mutual interference on automotive radar systems by building multiple radar systems and introducing mutual interference in controlled scenarios. The results from the hardware model validate the software simulation that provides a modular platform to test a wider range of traffic scenarios.

Project Magneto
***Broad-Spectrum Electromagnetic
Shielding in Consumer Electronics***

Liaisons: Amanda Rainer '06, Meng Chi Lee
Advisor: Matthew Spencer
Students: Nicole Subler (TL-S),
Da Eun Shim (TL-F), Josephine Chen,
Richard Piersall, Sam Dietrich (S),
Aaron Wang (S), Jeewan Naik (F)

The Project Magneto Team investigated new options for electromagnetic shielding in consumer electronics. The goal of the project was to identify materials with decreased volume and increased shielding effectiveness. The team designed and conducted a series of experiments to collect data on the electromagnetic power transmitted through a variety of materials. These measurements were used to quantify the shielding effectiveness of both traditional and non-traditional shield materials.

Proteus Digital Health

Hydration Monitoring Using Impedance Techniques

Liaisons: Rob Azevedo, Bob Leichner,
Lawrence Arne (Fall)

Advisor: Ruye Wang

Students: Nicole Kyle (TL), Kaitlin Kimberling,
Eric Kiss (S), Kelly Robertson,
Jesse Joseph (S), Cesar Orellana (S),
Nathaniel Miller (F)

Proteus Digital Health is interested in simple and noninvasive methods for measuring a person's hydration. The Proteus Clinic Team has been investigating whether it is possible to track a person's relative hydration using local impedance measurements, where electrodes are less than 10 inches apart on the torso. These measurements could be used in a clinical or home setting to monitor a patient's hydration levels.

Regenesis Biomedical, Inc.

Data Acquisition and Wireless Communication System for Postoperative Pain Treatment Device

Liaisons: Laurent Moreaux, Don Tate

Advisor: Lori Bassman

Students: Austin Fikes (TL-S), Eddie Gonzales,
Maggie Rabasca (TL-F),
Ramy Elminyawi,
Kelly McConnell (S)

The Regenesis Biomedical Clinic team is modifying the Provant® Therapy System, a medical device that delivers a pulsed electromagnetic field used for palliative treatment of postoperative pain. A new mixed-signal embedded system within the Provant extracts key data related to patient usage and device functionality and wirelessly communicates with a Regenesis database. Regenesis staff will use this system to confirm treatment regimen compliance and to remotely update therapy prescriptions.

SpaceX

Improved Leak Detection

Liaisons: Casey Schilling '08, Will Ferenc '13,
Graham Gordon '15, Jason Nimersheim

Advisor: Mary Cardenas

Students: Cory Johnson (TL -S),
Jeanette Liu (TL -F), Vicente Robles,
Lucia Kaye (S), Benjamin Kunst (S),
Jonathan Lum (S), Hannah Zosman (F)

SpaceX designs, manufactures, and launches advanced spacecraft. The SpaceX clinic project is to improve the 1968 NASA TM X-53692 standard for characterizing leaks in aerospace hardware. More modern and economical detection methods will be tested on an experimental rig with helium and diverse gas mixtures to verify classifications of various leak geometries.

Whistle Labs, Inc.

Wearable Ambient Temperature Monitoring

Liaisons: Nate Yoder '06, Kevin Lloyd '06,
Nicole Yu '14

Advisor: Mary Cardenas

Students: Christina Zeeb (TL-S),
Benjamin Chasnov (TL-F),
Minh Triet Nguyen,
Aishvarya Korde (S), Elizabeth Lee (S),
Joshua Sealand (S), Siyi Hu (F),
Joseph Sinopoli (F)

Whistle Labs, Inc. has developed a collar mounted GPS tracking device for pets that also includes temperature and activity monitoring in order to keep your pet safe. Whistle is particularly interested in preventing animals from being trapped in hot cars. The Whistle Clinic team was tasked with improving the ambient temperature sensing of this device to identify dangerous situations. The team developed a lumped element thermal model to assess device performance and evaluate potential sensor and form factor changes.

The Wildlands Conservancy

Micro-Hydroelectric System

Liaisons: Jason Laird, Doug Chudy, Paul Melzer
Advisor: Okitsugu Furuya
Students: Rose Martin (TL-F), Maggie Liu (TL),
Huting Lin (S), Michael Muzio (S),
Courtney Coyle (F),
Daniel McCabe (F),
Tyler Smallwood (F)

The Wildlands Conservancy has a natural, year-round water source at its Oak Glen Preserve that can be used to generate green energy. We have designed a micro-hydroelectric system optimized for the surrounding area that ties into the Southern California Edison grid to offset the property's power usage. Additionally, we have designed a second smaller system that will be primarily used to educate the Preserve's visitors about hydroelectric energy.

ENGINEERING/MATHEMATICS CLINIC

Pharmavite, LLC

Finite Scheduling

Liaisons: Danielle Scott, Bill Black,
Chris Johnson, Suraj Kute
Advisors: Patrick Little, Weiqing Gu
Students: Allison Barry (TL-S),
Aleina Wachtel (TL-F),
Stephen Schein, Kanak Singh,
Rachel O'Neill (S),
Jessica de la Fuente (F)

The Pharmavite clinic team worked on creating and implementing a finite scheduling tool to generate an optimized work order schedule for the manufacturing processes of Pharmavite's San Fernando facility. The tool will reduce current costs and non-value added time by minimizing bottlenecks, creating visibility to capacity constraints, and optimizing other factors.

ENGINEERING/PHYSICS CLINIC

Sandia National Laboratories

Measuring the Permittivity of Barium Titanate Nanoparticles in a Matrix-Free Composite

Liaison: Todd Monson
Advisors: Richard Haskell, Albert Dato
Students: Kaitlin Hansen (TL-S),
Kirk Lau (TL-F), Natasha Allen,
Ashka Shah, Shruti Singapur,
Scott Tan, Olivia Schneble (F)

The Sandia National Labs clinic team is working to determine the dielectric constants of barium titanate (BTO) nanoparticles for use in the next generation of electrostatic capacitors. By fabricating and studying composites of BTO nanoparticles suspended and cured in epoxy, the team is investigating the effects of nanoparticle size, volume loading, and surface functionalization on the dielectric constant of the nanoparticles through electrochemical impedance spectroscopy and numerical modeling techniques.

GLOBAL CLINIC

RainCatcher, Inc.

Low-Cost, Monitoring of Remote Rainwater Catchment Tanks

Liaison: Dave Zielski
Advisor: Brian Bryce
Students: Cherlyn Chan (F),
Cassandra Burgess (S),
Senghor Joseph (S), Jozi McKiernan,
Nithya Menon (TL-F),
Michael Lertvilai,
Heather Seaman (TL-S)

The 2015-2016 Harvey Mudd Global Clinic team is sponsored by RainCatcher, a non-profit organization working to combat the global issue of clean water access. RainCatcher has installed rainwater catchment systems in regions of Kenya, Uganda, and the Navajo Nation. The HMC Clinic team is designing and building a device which will communicate details about each tank to RainCatcher. This device will allow RainCatcher to collect quantitative data on their impact and improve the reliability of their systems.

MATHEMATICS CLINIC

EDR

Algorithms for Property Search and Identification

Liaisons: Zach Fisk, Paul Schiffer,
Richard White

Advisor: Darryl Yong '96

Students: Sean O'Keeffe (PM), Michael Libucha,
Ben Lowenstein, Bo Zhang

EDR provides a range of products to allow property stakeholders to manage their assets and liabilities. Many of EDR's products involve determining if two textual records refer to the same location. EDR would like to improve on the speed and accuracy of these comparisons through automated matching algorithms. Our team has developed a systematic approach to build and test matching algorithms grounded in probability and statistical learning theory.

HRL Laboratories

Analysis of Quantum Communication Network Protocols

Liaisons: Dr Jim Harrington, Dr Cody Jones

Advisor: Weiqing Gu

Students: Wenhao Lu (PM-S),
Yossathorn Tawabutr (PM-F),
Ben Johnson, Reyna Hulett,
Kilian Fa

This project is looking at ways to generate random numbers via shared entanglement on a quantum network. The eventual goal is a distributed randomness beacon using our quantum protocol. We started by looking at networks of 4 and 8 node planar graphs. We analyzed possible malicious actions to investigate the effects an adversarial node can have on the network. We also consider other network topologies as possible candidates for this distributed randomness beacon.

Microsoft Corporation

Anomaly Detection for Live Site Incident Detection

Liaisons: Debashish Ghosal, Gautam Dewan

Advisor: Rachel Levy

Students: Angela Chin (PM), Lucy Gao,
Alison Kingman, Sam Jun

Bing is a Microsoft search engine that currently holds approximately 30% of the search engine market. It is critical for Bing to ensure that service remains fast and reliable. This year the Microsoft Math Clinic Team implemented efficient and accurate algorithms to detect anomalies in Bing live site data. The team also created a tool to determine optimal parameters for different algorithms.

NOAA - Alaska Fisheries

Parameter Estimation on Marine Biological Models

Liaison: Dr. Kerim Aydin '92

Advisor: Alfonso Castro

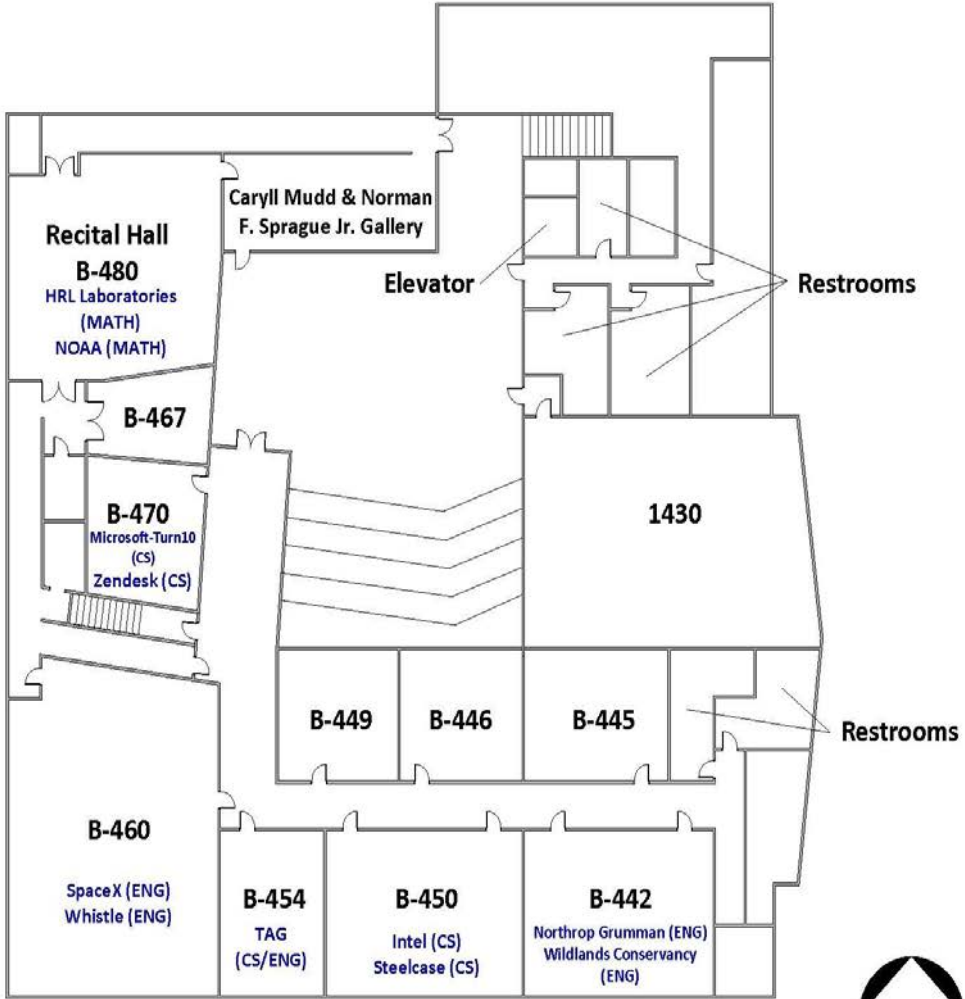
Students: Nathan Geldner, Tasman Loustalet,
Rowan Zellers

Understanding how fish populations change over time helps the National Oceanic and Atmospheric Administration (NOAA) to prevent overfishing and protect fisheries. The Ecosim model describes the change in biomass per species over time for an entire marine ecosystem. The model itself leaves many parameters unspecified which must be inferred from the data. Our goal has been to algorithmically determine sets of parameters which allow the Ecosim model to best predict our data.

Shanahan Center for Teaching and Learning

Basement

Projects Day 2016



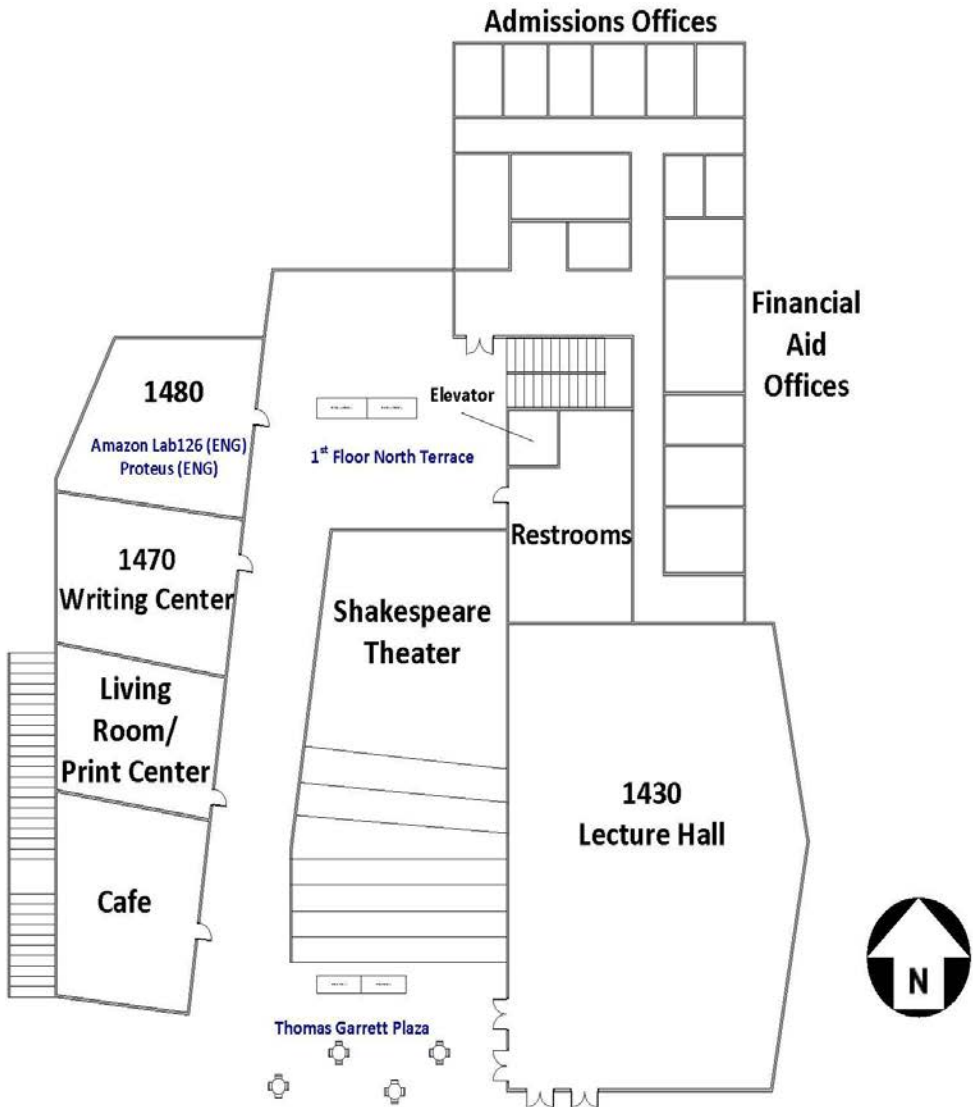
May 3, 2016



Shanahan Center for Teaching and Learning

First Floor

Projects Day 2016

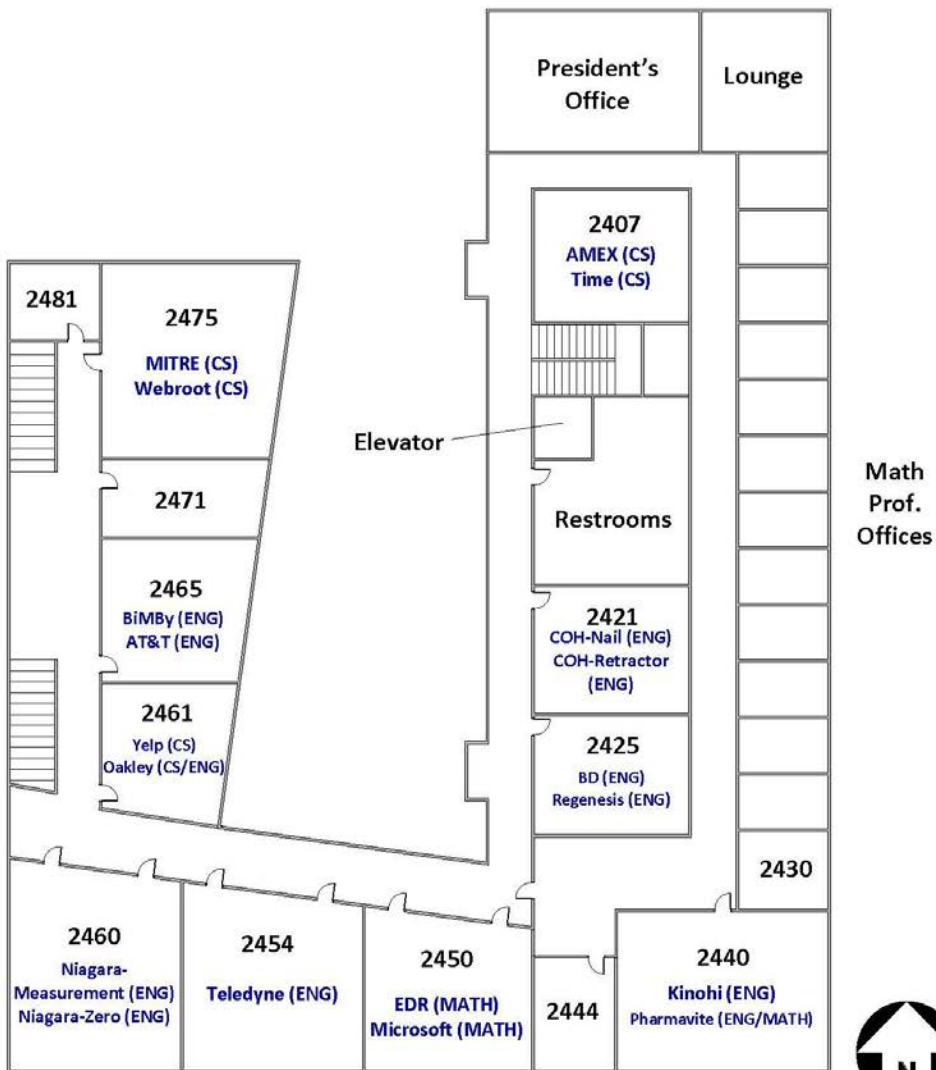


May 3, 2016

Shanahan Center for Teaching and Learning

Second Floor

Projects Day 2016



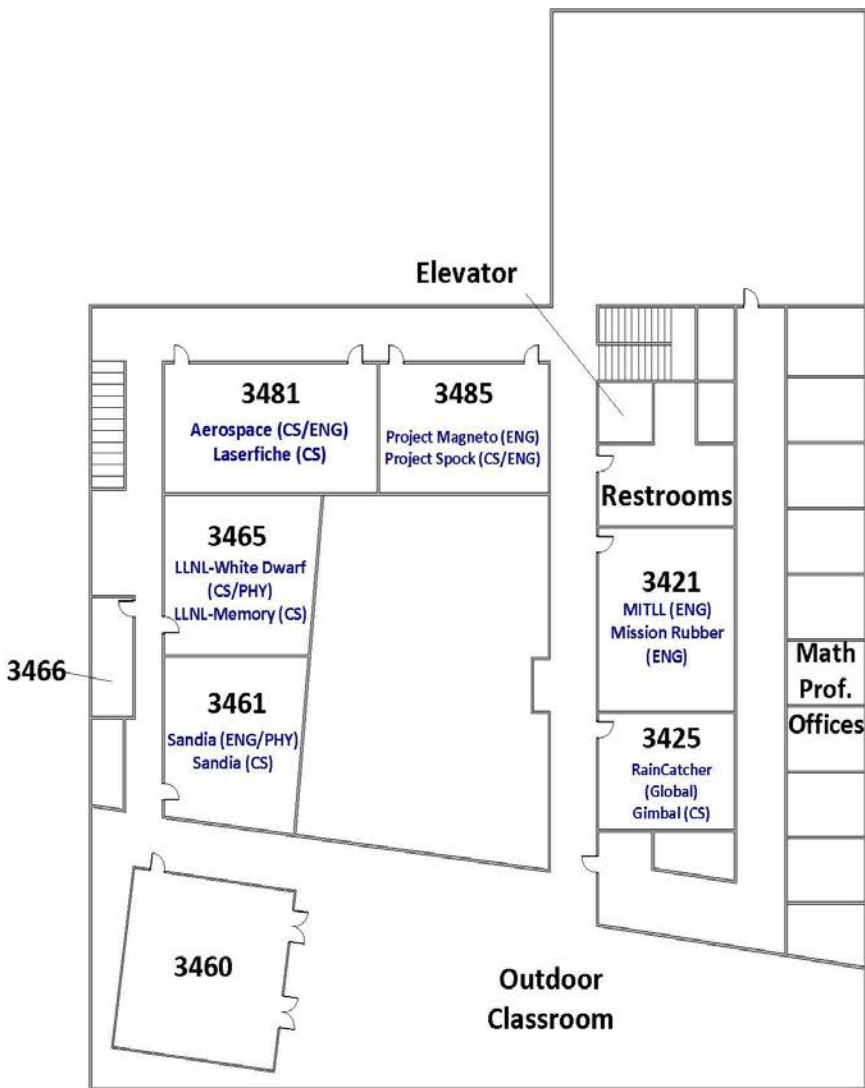
May 3, 2016



Shanahan Center for Teaching and Learning

Third Floor

Projects Day 2016



May 3, 2016



Harvey Mudd's annual celebration of student achievement includes Presentation Days (May 2 & 4, 2016), showcasing senior thesis research and class projects, as well as Projects Day (May 3, 2016), showcasing projects in the Clinic program.

Acknowledgments:

To all of the many Alumni and Parents who assist in the recruitment, formulation and conduct of Clinic projects year to year, and to the Clinic Advisory Committee who provide valuable industry perspective and advice. Your continued support is greatly appreciated.

&

To all Harvey Mudd College Faculty & Staff involved in the preparation of Projects Day

Harvey Mudd College

Clinic Program

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