

# HARVEY MUDD

## COLLEGE

### Students and Companies Benefit from Innovative Clinic Program

Since its founding in 1955, Harvey Mudd College has been dedicated to educating a special breed of scientists, mathematicians and engineers with exceptional breadth in their technical education, and a firm academic grounding in the humanities and social sciences. A key element in the education of Harvey Mudd College students is the practical, hands-on experience they receive through the college's pioneering Clinic Program, begun by the Department of Engineering in 1965 to channel student initiative, drive and intelligence into projects of a real-world nature. Founders Jack Alford and Mack Gilkeson felt that the best way to do this was to give students "clinical" experience like that which medical students receive—thus the name Clinic. Each project brings together a sponsor liaison, three to five students and a faculty advisor.

The Clinic Program includes projects in computer science, engineering, environmental sciences, mathematics, and physics. The Clinic director in each area carefully selects projects that have a major component in one or more of these disciplines.

#### Wanted: Problems

The Clinic Program depends entirely on the problems provided by the engineers, scientists and mathematicians at the sponsor companies: the untried problems, the open-ended problems that stretch the imagination, the authentic, complex and messy problems that stimulate creative thinking. The questions and problems that student teams face are typical of those regularly confronted by practicing scientists, engineers and mathematicians, and the solutions they devise must work in practice, not just in theory. Clinic teams plan and execute projects that have no textbook answers; the projects are their own work.

In addition to the focus on problem solving, testing and design the students also develop project management skills including budgeting and scheduling. Every Clinic project culminates in a written final report and a formal presentation at a year-end event called Projects Day.

#### Some Projects in the Works

Computer Science Clinic students are working with Optivus Technology, Inc. to implement a graphical user interface for the vacuum monitoring and control software for the Proton Beam Treatment System. For I/O Software, another team is developing a system to enable the sponsor's biometric (i.e., fingerprint) security system to be used to control access to the web sites. The ESRI, Inc. team is developing



HMC Clinic projects have benefitted (1) LLUMC (2) JPL (3) Bank of America (4) AeroEnvironment (5) JPL (6) GM. (7) Students learn project management skills, budgeting, scheduling and presentation reporting. Public presentations of Clinic projects occur on campus February through April each Tuesday at 11:00 A.M.

algorithms for efficient routing of vehicles over transportation links that open and close on a varying schedule. For Auditude.com, a Computer Science Clinic team is devising an algorithm to identify a piece of music based on its tune, rather than its specific frequency characteristics, so that songs could be identified regardless of the singer, recording environment or instrumentation.

The students in the Engineering Clinics are working on LED test automation for AXT; on the correlation of sprinkler nozzle performance to CFD for Rain Bird; on an image-based target localization system for proton radiosurgery for Loma Linda University Medical Center (LLUMC); and on innovative water treatment processes for the Metropolitan Water District.

Mathematics Clinic participants are optimizing an online query system for Fair, Isaac, and Company, Inc.; mathematically modeling the noise-temperature relationship of onboard infrared detectors for Northrop Grumman; using ion propulsion

to create efficient satellite orbit-raising in 3-D for Space Systems/Loral; and developing a prototype algorithm for elliptic curve key generation and a recommendation of key-exchange protocols for ViaSat, Inc.

In the Physics Clinic, students are working on a subsystem of the Space Interferometry Mission (SIM) for Jet Propulsion Laboratory. In last year's Environmental Studies Clinic, sponsored by Three Valleys Municipal Water District, the Clinic team analyzed the Harvey Mudd College landscape from environmental, social, and economic viewpoints and proposed alternative landscape designs and practices for the campus.

#### A Priceless Opportunity

Sponsors retain full rights to all intellectual property developed by the team. Sponsors regularly attest that the fresh ideas and project results have dollar values that far exceed the Clinic fee. One industry liaison said his company believed it could save

\$10-15 million in capital investments depending on its project's results.

"If we tried to do it in-house or hired an outside company it would have been five to ten times the cost [of the Harvey Mudd College Clinic Program]" said another company liaison. Perceived sponsor value is further evidenced by the fact that over half of our sponsors have returned for additional projects.

Indirect benefits of sponsorship include increased visibility on campus, which benefits a company's recruiting efforts. External visibility can also be raised: recent projects have been mentioned in numerous media outlets including *Popular Science*, trade journals, company newsletters, the *Los Angeles Times* and local newspapers. Being a company liaison can also provide useful management training experience to sponsor employees.

#### The Clinic Tradition

During the more than 35 years The Clinic Program has existed, more than 1,000 projects have been completed for 250 different organizations, many of them Fortune 500 companies. To see the variety of past projects, visit the Clinic Web pages at <http://www.clinic.hmc.edu>.

Inquiries are welcome from interested companies and organizations that wish to participate in the innovative Harvey Mudd College Clinic Program. For more information about the HMC Clinic Program, call 909/607-9887 or e-mail [clinic@hmc.edu](mailto:clinic@hmc.edu).

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