UCSD undergraduates study rocketry design at San Diego Supercomputer Center Summer Program

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UNDERGRADUATES STUDY ROCKET DESIGN TO OCEAN WARMING AT SAN DIEGO SUPERCOMPUTER CENTER SUMMER PROGRAM

Their projects span a wide range of time and space, exploring questions in rocketry design, ocean warming and particle physics to the development of a mathematical model of how the brain works.

It's all part of a summer fellowship program at the San Diego Supercomputer Center (SDSC), during which undergraduate students work on their own research projects with the help of SDSC staff members and faculty advisors from San Diego State University (SDSU) and the University of California, San Diego (UCSD).

The program, called Research Experiences for Undergraduates (REU), is funded by a $115,000 grant from the National Science Foundation. Each student receives $4,000 for the summer session, with the remainder of the grant for staff and resource support.

Eighteen students have been selected for the program, 13 from the University of California, San Diego (UCSD) and three from San Diego State University. The other two are from the Massachusetts Institute of Technology (MIT) and Harvard University, although the parents of both reside in San Diego.

Last summer, only local university students were selected.

"This year we've decided to take a couple of students from off-campus and see how we can accommodate them," said Hassan Aref, SDSC chief scientist and co-director of the REU program with Rozeanne Steckler, SDSC chemist and adjunct professor.

"Next year, we may advertise nationally to get students from all over the country," he added.

Aref, also a UCSD professor, said that the program helps to motivate promising students to pursue careers in engineering, mathematics and science. Each student has a faculty advisor and an SDSC advisor.

By participating in graduate level research, the students also gain confidence in their abilities, he said.

"A number of students get a healthier perspective on what they might do after graduation," Aref said. "We've seen a few students whose GPA (grade point average) goes up, even though they already were high, and we've seen a few go directly into graduate school who otherwise would rather have gone to work."

Each student is chosen by a committee of SDSC staff members. Besides academic credentials and recommendations, the proposed project of the student must be heavily computational, although supercomputer usage is not required. However, originality counts.

Among the eight students selected for last summer's program was Vera Saliba, a blind UCSD computer science student, who spent her time developing a Braille tutorial program for the PC.

Recently, NSF officials invited Saliba to Washington, D.C. to demonstrate her program.

Another student, Carlos Benitez, studied the biomechanics of human locomotion to develop a mathematical model to describe walking. Benitez also was accepted to this summer's program.

"I think the goal this summer (for Benitez) is to write an expository article to describe what he has done," said Aref, who has been Benitez' faculty advisor.

Some members of this summer's group hope to achieve immediate practical results. Others have longer-range goals.

One student is attempting to create a series of computer- animated sequences of buildings to help architects design more comfortable and efficient structures. Another is attempting to develop a new method for sorting large molecules of DNA, a tool that could be valuable to programs like the Human Genome Project. Yet another is trying to create an accurate model for a "smart" two-wheeled vehicle, an early step along the path to unmanned vehicles for manufacturing or space exploration.

Sridhar Venkatesh, a sophomore electrical engineering student from MIT, will spend his time investigating the benefits of autotasking, a tool that automatically reads a program and translates it for use in computers with multiple processors.

"If I weren't here, I would be working in a company," said Venkatesh, a graduate of Torrey Pines High School in La Jolla.

"By the end of the summer, my adviser and I will be able to make recommendations to users about whether autotasking is worth the overhead that it incurs," he said.

Mike Casey, a third-year UCSD student majoring in mathematics, has been trying to create a computer model, based upon certain mathematical principals and "building blocks," of how the human brain works.

"I want to find out what the building blocks are in neural computation and then take those and create a model of the brain," he said. "Then we can put those in an environment (where they can evolve) and hopefully, we can come up with some intelligent system."

This summer's program even has a rocket scientist on board, although he won't be working at the supercomputer center.

Brian Lue, a fifth-year UCSD student majoring in mechanical engineering, will be participating in the summer program via modem from a private rocketry company in San Jose.

Lue will be attempting to simulate a vibrational instability called "Pogo" (from Pogo stick), that results when liquid fuel sloshes against the walls of a rocket fuel tank during launch. The resulting vibrations can be passed on through the fuel line into the rocket propulsion system, resulting in premature engine shutdown.

"I'm trying to model the vibration to find out what combinations would lower Pogo," Lue said. "If you do have Pogo and vibrations are serious enough, it can damage payloads. You can lose customers that way."

Fellows and their advisors will meet in weekly seminars during the 10-week summer session. Final reports on the summer projects will be delivered at a public seminar to be held in September.

SDSC, one of four national supercomputer centers established by the National Science Foundation to serve the U.S. research and development community, is administered and operated by General Atomics at UCSD. Although the center program was established for the academic research community, computer resources also are provided for industry use.

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