

Director's Statement For 1993/1994

1. Goals of ICS

The overriding goal of the ICS is to achieve an increased understanding of the crust and lithosphere of the earth, both on the continents and under the oceans, by utilizing the approaches of many disciplines and the expertise of scientists in academia, government, and industry.

2. Current mission of ICS

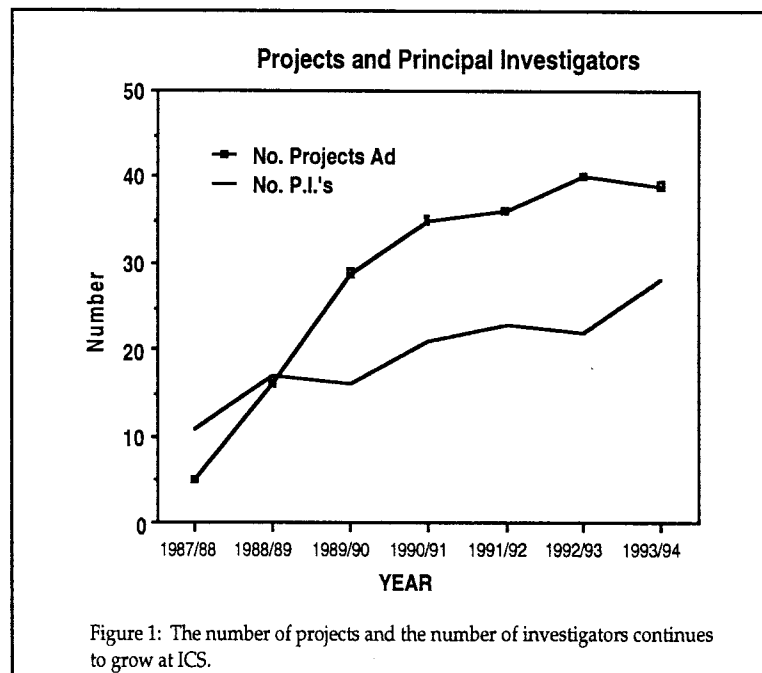
The current mission of the ICS is to provide the research leadership, organizational structure and facilities to promote the cooperation of scientists from various research groups and organizations on problems concerning the earth's crust which are on a scale greater than those which can be studied by one investigator, or one group of investigators.

At present the research agenda of the ICS comprises the study of *crustal structure and tectonics*, how the crust is put together and deformed; *crustal materials*, what the crust is made of and what are its physical properties; *earthquakes*, how, when and where they occur in the crust and how strong they are; and, *hazardous waste disposal*, how industrial and nuclear materials can be safely disposed of in the crust.

3. Instructional and research activities of ICS

3.1 ICS facts

This past year ICS researchers worked on 39 projects all over the world. Historically, the number of projects has grown at a faster rate than the increase in scientific staff at ICS (Figure 1). We now count 29 in



our scientific staff. We submitted 43 grant requests and were awarded 22. New awards amounted to \$1,853,961 this year. Our scientists submitted or published 28 scientific papers during the past year. ICS scientists and students presented papers at national meetings of the American Geophysical Union, Geological Society of America and Seismological Society of America.

3.2 ICS students

Dramatic growth has occurred in the numbers of students involved in research. During 1993/94, 44 students worked on ICS projects, including 29 undergraduates and 15 graduate student researchers. In our

Erick was also recognized by the Pacific Section of the American Association of Petroleum Geologists and received their van Covering award for student excellence.

Professor Art Sylvester has a unique project funded by the NSF program for research experiences for undergraduates. His project involves high-precision leveling across major faults in the Grand Teton range of Wyoming to determine the rate of uplift of these mountains. The project has run for four summers. Nine undergraduates accompany him on two week trips to the study area. Students are involved in the design and execution of the

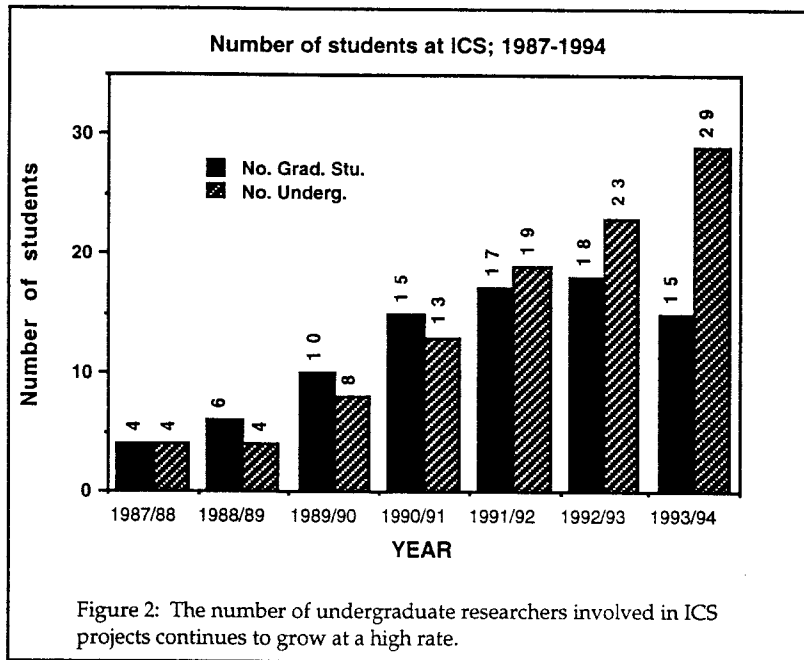


Figure 2: The number of undergraduate researchers involved in ICS projects continues to grow at a high rate.

first year of operation we counted only 8 students (Figure 2). Our students continue to be productive, presenting papers at meetings and authoring and co-authoring publications.

Undergraduate research activity last year at ICS included two internships sponsored by the Southern California Earthquake Center awarded to Geo. El and Erick McWayne. Erick studied the structures underlying the Santa Barbara Channel with the idea of locating major fault systems. Geoff studied the earthquake sequences associated with the 1992 Joshua Tree and Landers earthquakes.

survey, processing of data, and interpretation of the results. Precision of a few millimeters over a 17 mile baseline has been achieved.

3.3 Research highlights

Our researchers responded promptly and with vigor to the January 17 Northridge earthquake. Within hours they were on the road headed to the epicentral region to deploy portable seismic stations. Over the ensuing weeks our stations gathered many mega bytes of data on aftershocks. The purpose of this was to map the faulting at depth but most important, to gather fundamental data on how ground motion in specific regions responds

to earthquakes; these are parameters crucial to seismic safety design. Along with this, ICS researchers continue to study ways to estimate ground motions in a variety of situations given actual field data on ground response.

ICS researchers Ralph Archuleta and Scott Swain are beginning a major new project which involves instrumenting a 520 meter hole into crystalline rock in Garner Valley, near Hemet. The hole will be instrumented with seismometers and water pressure sensors. This project is aimed at studying the relation between seismic activity and ground water movements. The main question is the ultimate safety of underground hazardous waste disposal sites in seismic regions.

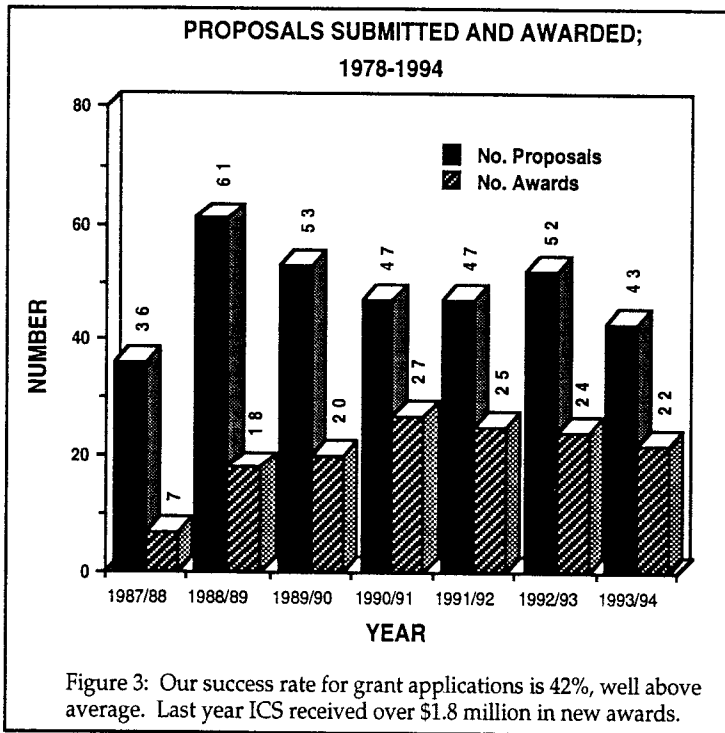
A new effort this past year has been direct investigation of the seismic hazard in the Santa Barbara Channel. This includes a study on the offshore extension of the Oak Ridge fault, the system believed responsible for the Northridge quake. In parallel with this has been a study of the overall deformation in the Channel. Using a unique numerical scheme, researchers have unraveled the mapped deformation of the subsurface rocks beneath the Channel waters. In doing so they have determined a direct estimate of the closure between the islands and the mainland.

4. Meeting the needs of the public

The research agenda of the ICS impacts directly three areas of social concern: energy and mineral

resources, public safety, and environmental quality. Studies in crustal structure and materials concern the makeup of the crust which is the reservoir for oil, gas and mineral deposits. One ICS project is focusing on the deep structure at the south end of the San Joaquin Valley which is a rich petroleum province. Research in earthquakes concerns both earthquake prediction and estimating ground motion from earthquakes. Expected strong ground motion is being studied at several locations in California, in a project sponsored by the Nuclear Regulatory Commission and the USGS. ICS continues it's active participation in the Southern California Earthquake Center (SCEC), a National Science Foundation Science and Technology Center. ICS is a major partner along with 6 other universities, and the U.S. Geological Survey. This project includes studies by ICS in the areas of regional seismicity, subsurface imaging of earthquake zones, fault zone geology, seismic hazards analysis, and geologic (tectonic) history. Some details of our research through the center are described below in the Research Section.

The movement of hydrocarbons in soils and sediments is studied in our Vadose Zone Monitoring Lab. This project is attempting to define controlling parameters on the migration of liquid and gas hydrocarbons in the crustal layer above the water table (vadose zone). This is applicable to the mitigation of the problems from leaking hazardous waste landfills



measured by comparing 93/94 awards against 92/93 submissions (Figure 3). This is well above the national averages of 20 to 25 % in earth sciences. ICS continues to show growth in the dollar amount of new awards received. This year \$1.85 million were received. Over the past 7 years our average rate of increase in new awards has been 24% per annum. Total funding support from UCSB includes core budget plus intramural awards for special projects and matching funds commitments. After an abrupt decrease following

and underground hazardous liquid storage tanks. The project is funded by the Environmental Protection Agency.

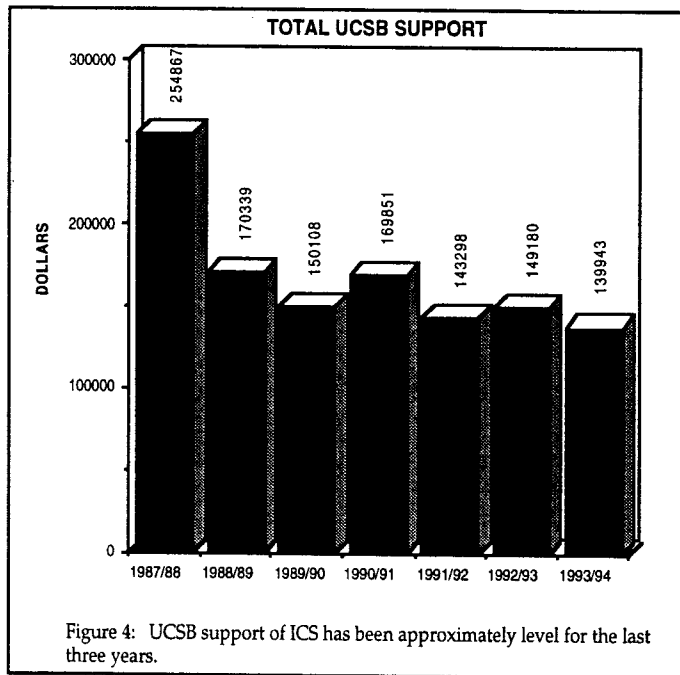
first year start-up funds, total support has leveled off (Figure 4). Total UCSB support is now 7.5 percent of new awards.

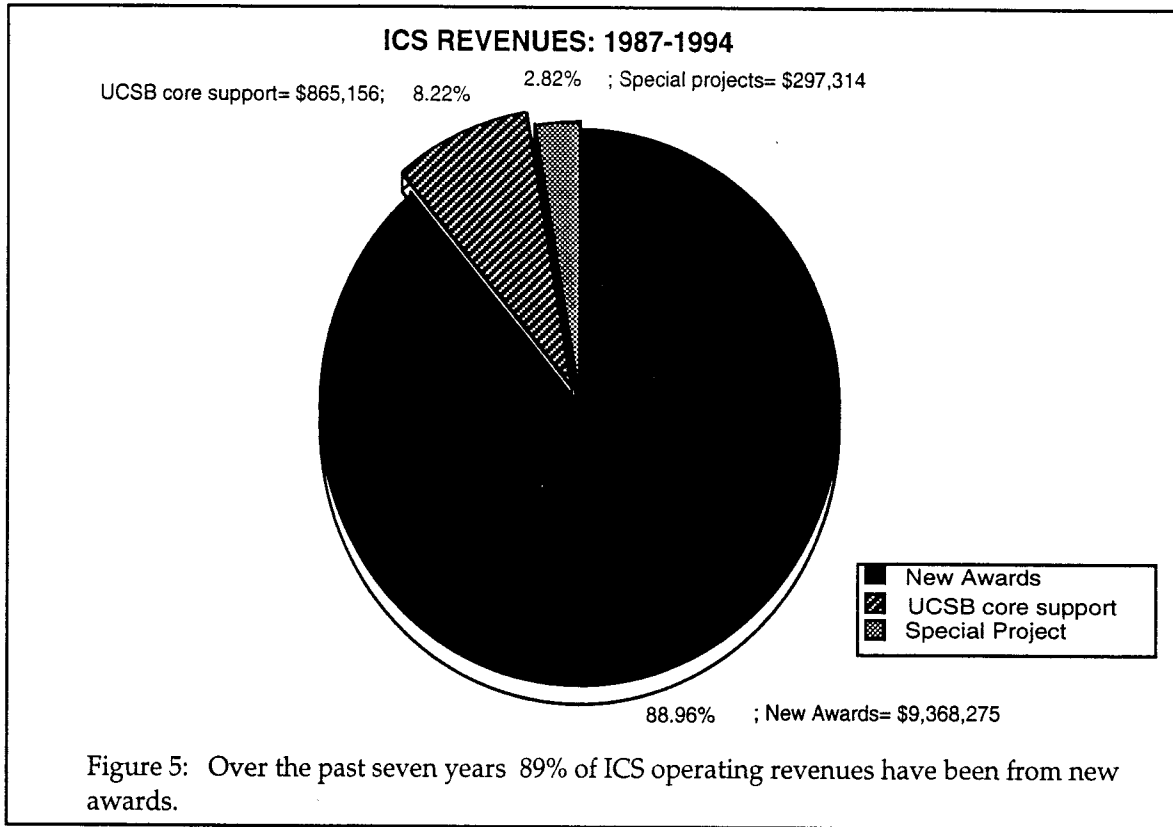
ICS staff and researchers were deeply involved in the media coverage following the Northridge earthquake. We gave interviews to TV stations KEYT and KCOY including a live broadcast from ICS over KEYT. ICS staff was also interviewed by local newspapers and radio stations.

The cumulative revenues of ICS for the past 7 years are \$10.5 million (Figure 5). New awards to

5. Present, Past, and future

5.1 Research support ICS researchers continue to submit research grant proposals at a high rate. Last year we submitted 43. Our requests were to 9 different agencies, pointing out the diverse nature of our activities. Our success rate is 42%,





UCSB comprise \$9.4 million or 89% of total revenues.

5.2 Move onto the main campus

During the latter part of 93/94 ICS staff began to prepare for our move from the Hollister Research Center to Girvetz Hall on campus. We met with architects and campus

planners and discussed renovation of the space formerly occupied by the Computer Systems Lab. Construction started in the Spring and the move was ultimately completed in August. The move resulted in a loss of about 800 ASF to ICS.