

## Director's Statement For 1992/1993

### 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 40 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 31 in our scientific staff. We submitted 52 grant requests and were awarded 24; a success rate of 51%. New awards amounted to \$1,760,001 this year. Our scientists submitted or published 35 scientific papers during the past year. For the fall national meeting of the American Geophysical Union, ICS researchers made a total of 15 presentations.

#### 3.2 ICS students

Dramatic growth has occurred in the numbers of students involved in research. During 1992/93 41 students worked on ICS projects, including 23 undergraduates and 18 graduate student researchers. In our 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. Graduate student Jaime Steidl has looked at different methods for quantifying the amplification of ground motion during large earthquakes. Steidl's analysis and subsequent paper resulted in his winning the student paper competition sponsored by the Earthquake Engineering Research Institute (EERI). Steidl was invited to talk at the EERI annual meeting in Seattle and publish his paper in the EERI journal *Earthquake Spectra*. Two other ICS graduate student researchers received awards from the

## SCIENTISTS AND PROJECTS 1987-1993

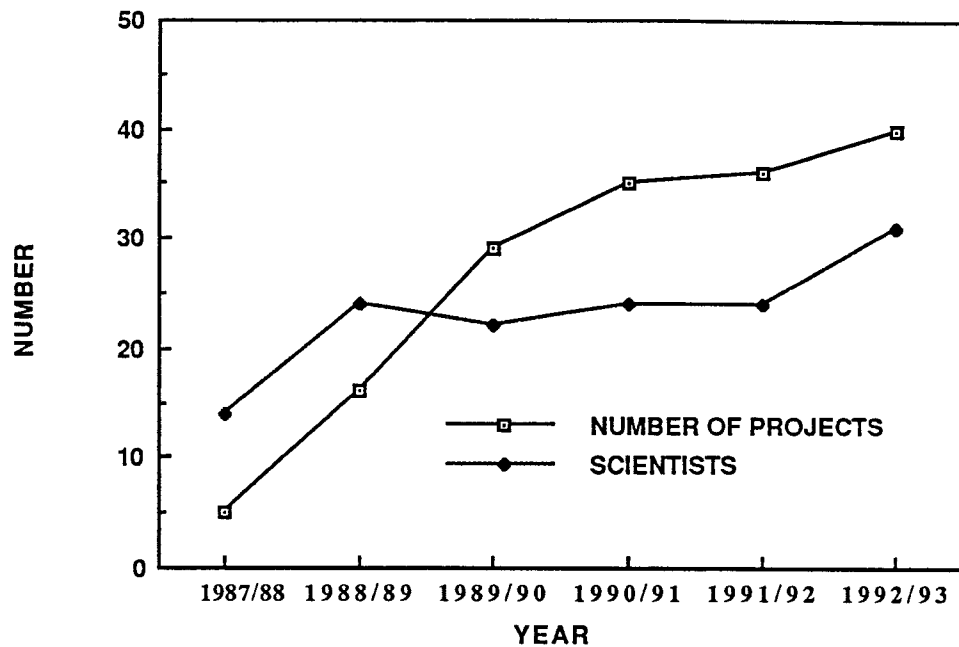


Figure 1: The number of projects has increased faster than our number of scientific staff (faculty, professional researchers, postdoctorals, specialists, and postgraduate researchers).

UCSB Geological Sciences department. Doug Imperato received the Wendel Woodring graduate fellowship to continue his work in the Central Valley of California, and Christine Smith received the "Against All Odds" award for her field research in Antarctica. Two ICS undergraduate research assistants who work on Art Sylvester's survey projects received awards. Les Hasbargen received a travel award from the Geological Society of America. He was also awarded the Geological Sciences department (UCSB) Charles Woodhouse award; the department's highest. Susan Dougherty received the department's William Bushnell award.

Prof. 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. Eight undergraduates accompany him on two week trips to the study area. Students are involved in the design and execution of the 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

Although the Landers (California) earthquake occurred at the end of 1991/92, the research on it began in 1992/93. A collaborative

investigation of the June 1992 M7.4 Landers and M6.5 Big Bear earthquakes was undertaken by several groups associated with the

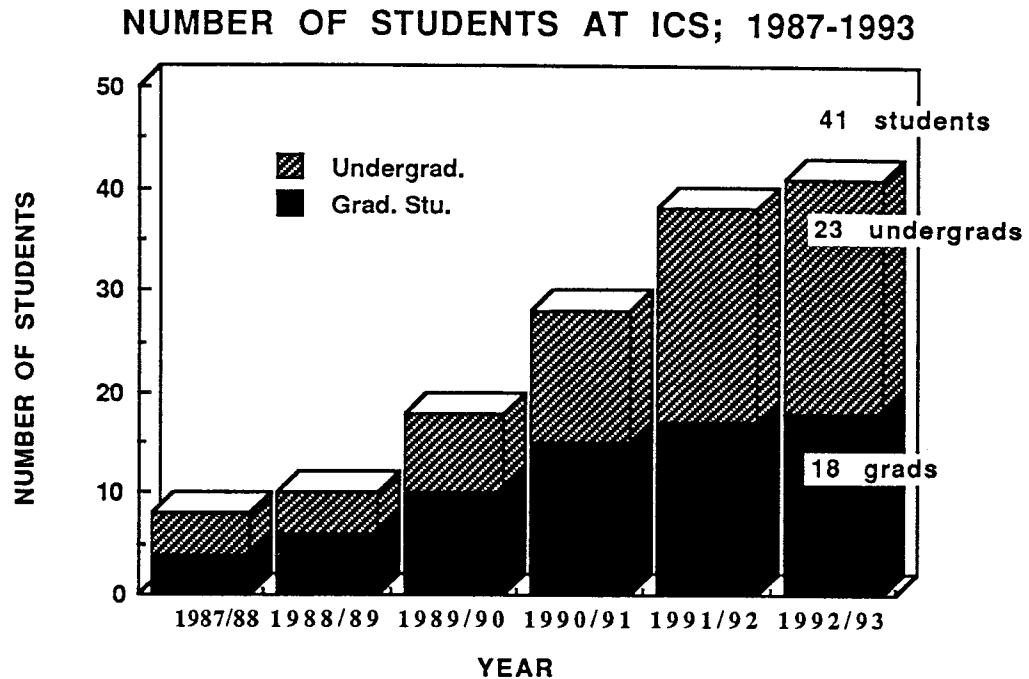


Figure 2: We now employ more students than scientists at ICS.

Southern California Earthquake Center (SCEC), including Caltech, UC Santa Barbara, USC, UC San Diego, SDSU, IRIS/Passcal and the USGS. The M7.4 Landers earthquake and the M6.5 Big Bear earthquake occurred in the early morning hours of June 28. Four portable instruments were installed and operating within 12 hours, two in the San Bernadino Mountains near Big Bear, and the other two in the epicentral region of the Landers earthquake. By Tuesday, June 30, another 13 portable instruments were installed and operating. Over 8 Gbytes of earthquake data have been collected comprising approximately 8,000 events.

Robert Crippen, visiting scientist from JPL, studied before-and-after high resolution satellite images of the Landers surface rupture. Using new cross-correlation techniques he was able to quantify the ground displacement to within one meter. He made a video which shows the contrast between the surface before and after the Landers shock.

ICS researchers Bruce Luyendyk and Christine Smith continued their research in western Marie Byrd Land, West Antarctica this past winter. They participated in a German national expedition (GANOVEX VII) which traveled to Antarctica by ice breaker from New Zealand. Their research focused on the Edward VII Peninsula adjacent to the Ross Sea. Along with German and other European scientists they explored a broad region by helicopter during a period of one month. More detail of ICS research activities is provided in the following section.

Our unit has continued our seminar series where both on campus and off campus scientists lecture. During the past year we held 17 seminars at ICS. All seminars were well attended by graduate students, faculty, researchers, staff, and the community.

At the invitation of the United States Naval Civil Engineering Laboratory (NCEL), the ICS Vadose Zone Monitoring Lab staff were asked to co-chair the National Underground Storage Tank Conference held at UCSB. At the end of the conference, Ms. Elsie Munsell, Assistant Secretary of the Navy, and Dr. Bill Powers, Program Manager within the NCEL, initiated a dialogue directed toward establishing a long term working relationship between UCSB and the US Navy. Dr. Lorne Everett served as co-chair of the conference and Stephen Cullen served as Technical Advisor and Host for a multi-agency tour of VZML facilities.

The ICS has achieved national and international recognition as is evidenced in part by an increasing number of prominent long-term visitors. This past year we hosted visitors from MIT, Stanford, Yale University, Western Washington University, the USGS, the Jet Propulsion Lab of Cal Tech, ACTA Inc., the Geological Survey of the Netherlands, Canterbury University (New Zealand), the University of Paris VII, and the Université de Joseph Fourier, Grenoble, France, Catania University, and the University of Naples, Italy.

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

During 1988/89, we organized an Earthquake Advisory Group (EAG) within ICS. This is a group of Principal Investigators who can

interface with the public and media on earthquake related issues. We have also prepared maps and displays for use in media interviews. Within the campus phone directory are listed the names and phone numbers of the EAG under the heading "Earthquakes". On June 26, 1992 ICS instituted an earthquake information hotline phone number which plays a recorded message giving current information on significant earthquakes. Ironically, the Magnitude 7.4 Landers and M6.5 Big Bear earthquakes struck just two days later. ICS gave several press conferences to local television stations concerning the June 28 shocks and also the April Joshua Tree earthquake (M 6.1) which may be a foreshock to the June events. Director Bruce Luyendyk appeared live on KEYT news (channel 3 in Santa Barbara) on the evening of June 28. ICS researchers Craig Nicholson and John Crowell were also interviewed by local television stations during the first week of July. These included visits to ICS by KSBY channel 6, KABC channel 7, and KCOY channel 12.

Members of the Vadose Zone Monitoring Lab staff have been involved in numerous invited lectures on environmental issues surrounding hazardous waste and ground water quality. They presented lectures for: the United Nations Environmental Program at San Jose, Costa Rica; the European Community's research facility at Espra, Italy; UCLA Extension Program, California Department of Toxic Substance Control; California Ground Water Association at Los Angeles and San Francisco; Fundamentals courses on Ground Water Monitoring for American Ecology in Washington D.C.; US Department of Energy at Rocky Flats; the National Education and Environmental Program sponsored at Seattle, Washington; and the Santa Barbara County Environmental Health Program meeting at Santa Maria.

## **5. Present, Past, and future**

### **5.1 People, 92/93**

John Crowell received the Career Contribution Award from the Geological Society of America in March. John's contributions in the fields of strike-slip faults, especially the San Andreas fault, sedimentation in fault-bounded basins, and on ancient glaciation in the southern hemisphere were recognized. Stan Peale received the Brouwer award of the American Astronomical Society, and Hugo Loaiciga was awarded the Huber Award of the American Society of Civil Engineers. Toshiro Tanimoto's work on tomographic study of the earth's crust and mantle attracted the attention of the media on two occasions; an article in *Science News* and mention of his research in the magazine *Discover*. Bob Crippen had the Landers earthquake rupture video shown on *CNN*, and reported by *USA Today* (front page), and the *Santa Barbara News Press* (front page). Ralph Archuleta was elected by the Board of Directors of the Seismological Society of America as Vice President of that society.

We had both loss and gain of personnel last year. Researchers Rebecca Morris and Sandra Seale departed; Morris to UCLA and Seale to devote more time to her family. ICS lost administration staffers, Anne Glenister and Donna Welch. Anne left to move to employment out of the area, while Donna left to explore different career opportunities.

Professor Toshiro Tanimoto was appointed to the Geological Sciences department and to ICS. Tanimoto's associate, researcher Junho Um also joined ICS. Researcher Jess Taylor joined Ralph Archuleta's group.

Several ICS people earned promotions. Maureen Evans was promoted to Management Services Officer. Craig Nicholson and Stan Cisowski were promoted to Associate Researcher. Grant Lindley was promoted from Graduate Student Researcher to Assistant Researcher.

TRIP (Time Reduction Incentive Program) savings was voluntarily taken by Maureen Evans.

5.2 Infrastructure, 92/93

We have organized a library at HRC for ICS during the last year. This includes a generous number of volumes contributed by John Crowell, along with current journals. The holdings are cataloged and in a database which permits searching by a variety of criteria. A significant acquisition for the library was the entire Bulletin of the Seismological Society of America, beginning with volume 1, number 1, 1910. These were donated to ICS by Toshiro Tanimoto. We obtained a number of peripherals for our Sun 4/670 system. These include high capacity storage devices and laserprinters. Also, we set up a Macintosh IICI as a public access networked computer.

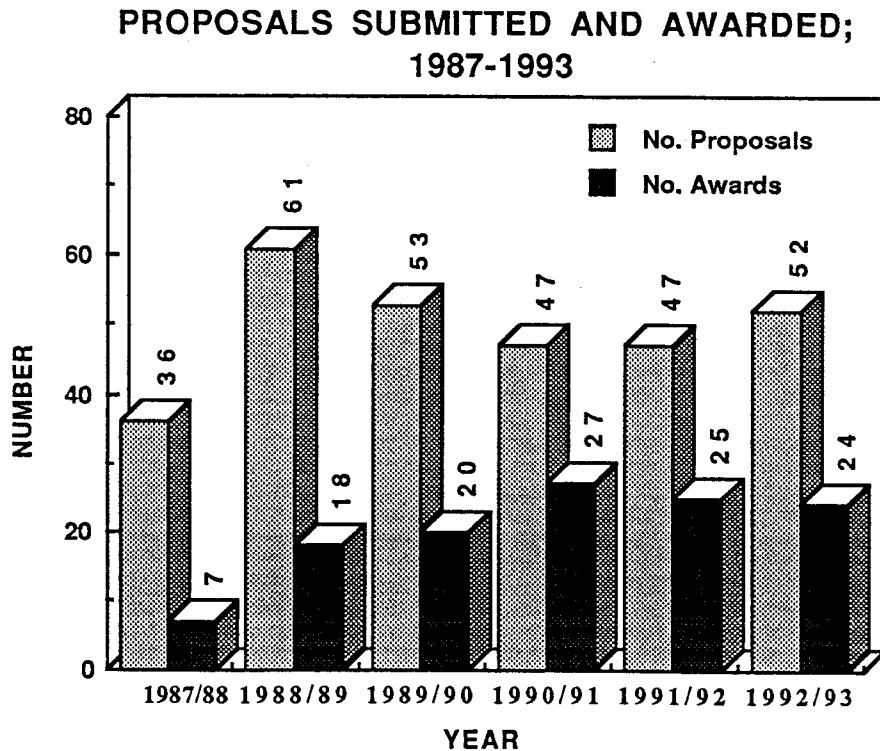
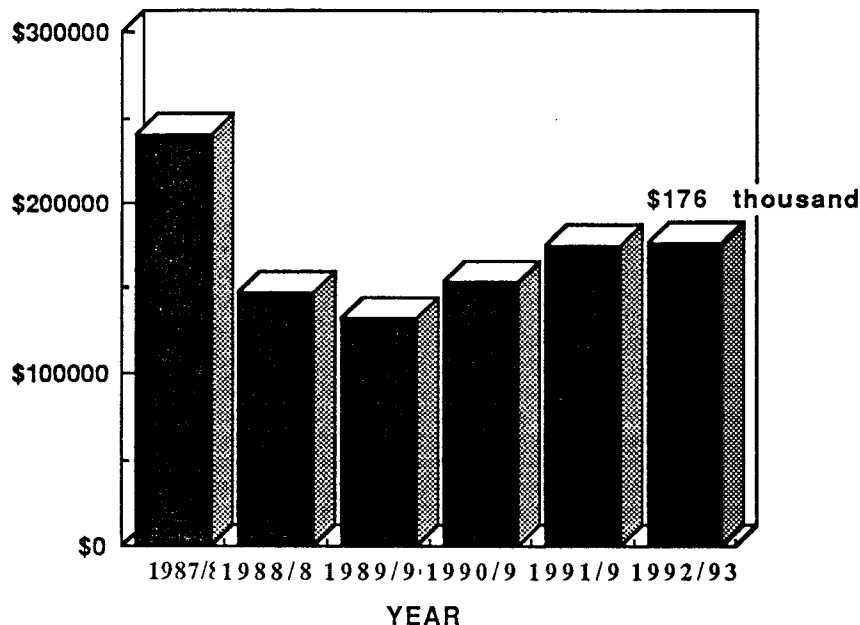


Figure 3: Proposal submissions are up, and our success rate is 51%.

### 5.3 Historical perspectives

ICS researchers continue to submit research grant proposals at a high rate. Last year we submitted 52, up from 47 the previous year. Our requests were to 14 different agencies, pointing out the diverse nature of our support. Our success rate is 51%, measured by comparing 92/93 awards against 91/92 submissions (Figure 3). This is well above the national averages of 25 to 35 % in earth sciences. ICS continues to show growth in the dollar amount of new awards received (Figure 4). This year \$1.76 million were received. Over the past 6 years our average rate of increase in new awards has been 16% 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 first year start-up funds, total support has slowly increased (Figure 4). Total UCSB support is now ten percent of new awards.

**TOTAL UCSB SUPPORT: 1987-1993**



*Figure 4: Total support per year from UCSB to ICS abruptly decreased after our first year and has since been slowly increasing.*

The cumulative revenues of ICS for the past 6 years are \$9.6 million (Figure 5). New awards to UCSB comprise \$8.5 million or 88% of total revenues.

### 5.4 Impending changes

ICS is scheduled to move from its main location at the Hollister Research Center to the main campus in Spring, 1994. We will be moving into space in Girvetz Hall vacated by two ORUs; Computer Systems Lab (CSL) and CRSEO (Center for Remote Sensing and Environmental Optics)

This move will involve downsizing from about 5000 ASF to 4200 ASF, a reduction of 16% in ASF space. Some HRC activities will need to find

### ICS REVENUES: 1987-1993

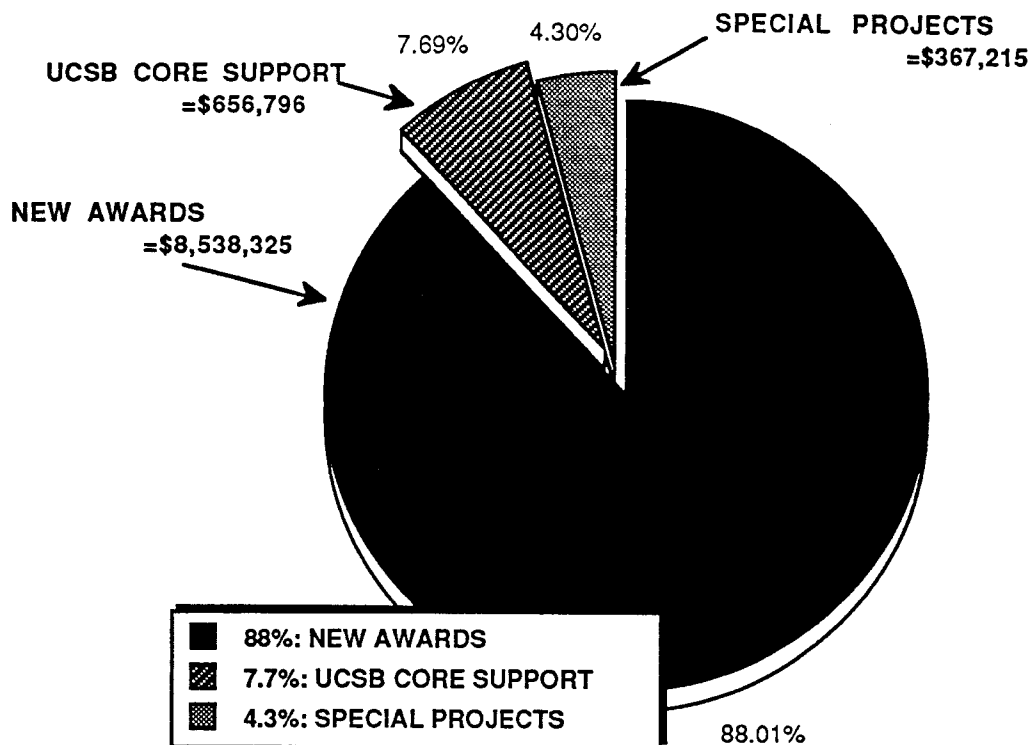


Figure 5: New awards have been 88% of total ICS revenues.

other locations. We are trying to coordinate this with the Geological Sciences department. Funds for renovation are not now available and this means HRC occupants will need to adapt to existing office divisions in Girvetz. Benefits of this move outweigh the negatives. We will be part of the campus daily life and accessible to many more Principal Investigators and students. The Girvetz space is centrally located and adjacent to the library.

As part of making ourselves a new home in Girvetz ICS will be drawing up plans for teleconferencing. We are studying what this will entail. Clearly this is the next stage of electronic communication and we want to participate at the beginning.

ICS researchers Ralph Archuleta and Scott Swain are beginning a major new project during the coming year which involves drilling a 600 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. This is a start-up project and it is not now known what size it could ultimately grow to.