Earthquake-Damaged Big Bear Solar Observatory Reopened

Caltech’s (the California Institute of Technology) Big Bear Solar Observatory, damaged by the June 28 Landers and Big Bear earthquakes, was reopened in early November, 1992, after more than four months of repair work.

The magnitude 6.6 Big Bear earthquake, centered a mere six miles from the observatory, almost rocked the three-telescope system off its supports and ruined much of the precision machinery that steers the five-ton instrument. The telescopes sit on a steel pedestal, which is anchored to a concrete pier. The shaking bent the pedestal and sheared off its retaining bolts, and created a large crack and countless smaller fissures in the concrete. Large chunks of concrete fell off the pier in places, exposing the anchor bolts within.

The shaking also destroyed many pieces of machinery, including a gear that helps the largest telescope follow the sun. The pivots and drive systems of the two smaller telescopes were damaged. A film container from one of the small instruments struck and damaged a computer-controlled light filter on the large telescope. Fortunately the Landers earthquake, which struck a few hours before the Big Bear event, caused a power failure, so none of the computers at the observatory were running or damaged when the second tremor hit.

Outside the building, scientists were alarmed to see crevices several feet deep, four feet wide, and up to 200 feet long in the causeway that links the observatory, built 1/5 mile out in Big Bear Lake, with the shore. Parts of the causeway had also subsided up to six feet and several boulders, some weighing upwards of two tons, had shifted by as much as ten feet. The researchers later learned the ground movement had destroyed some of the underground utility lines to the dome.

Within days after the earthquakes, staff members had removed all the electronics, cameras, and measuring instruments from the telescope system, and a rigging company had hoisted the three-telescope system out of the observatory building. While the instrument sat on shore in a garage, engineers from the Big Bear Solar Observatory, Caltech’s Owens Valley Radio Observatory, and Caltech’s civil engineering department worked together to design and fabricate new telescope drive systems, a stiffer steel pedestal, and a new, stronger concrete pier.

The crane returned on September 28, exactly three months after the earthquake, to replace the telescopes in the observatory. Staff members then spent several weeks reassembling the optical and electronic instruments on the telescopes, and in early November scientists recorded the first images of the sun since the quake.

Recovery

Report on Armenian Quake

EERI members Mishac K. Yegian and Vahe’ G. Ghahraman, of the Department of Civil Engineering, Northeastern University, recently published a comprehensive report on the 1988 Armenian earthquake titled The Armenia Earthquake of December 1988, Engineering and Reconstruction Aspects.

Both authors were invited by the Armenian Government to assess and investigate damage immediately after the earthquake. They participated in reconstruction efforts in Armenia periodically over the next three years. A National Science Foundation grant made it possible for them to expand their investigations to include in-depth seismological, geological, geotechnical, and structural engineering studies on the earthquake. The authors also participated in reconnaissance and reconstruction efforts following the June 1990 Manjil, Iran, earthquake. In the report, they compare the recovery experiences in the two countries.

A limited number of copies of the report are available free of charge from the authors.