1999 SCEC Annual Progress Report

Portable Broadband Instrument Center

PI: Ralph J. Archuleta
Institute for Crustal Studies
University of California, Santa Barbara

Project: Portable Broadband Instrument Center (PBIC)
PI: Ralph Archuleta, *ralph@crustal.ucsb.edu*
Associates: Aaron Martin, *aaron@crustal.ucsb.edu*
Peter Rodgers, *rodgers@crustal.ucsb.edu*
Institution: Institute for Crustal Studies
University of California, Santa Barbara 93106

The PBIC had a very active year of field activities ranging from assisting in deployment of borehole stations as part of the SCEC borehole initiative to the Hector Mines RAMP deployment. General equipment usage was extensive and mainly split between several large projects. The CMG-40T's were successfully used in several of these field experiments, and the ARGOS satellite telemetry system obtained last year proved its worth in several different operating environments.

Equipment Usage

The year started off with the LARSE II passive experiment, managed by Dr. Kohler (UCLA), using most of the PBIC equipment. Dr. Steidl's (UCSB) Portable Borehole project maintained one PBIC station throughout the LARSE passive deployment. Once the passive phase of the LARSE II project was completed some of the available stations were redeployed for the Portable Borehole project. In early October all the stations were pulled in preparation for the active phase of LARSE II. PBIC personnel assisted in multiple phases of both deployments. The occurrence of the Hector Mines earthquake, just prior to the beginning of the LARSE II active phase, created some scheduling and field logistical issues for the PBIC, but had only a minimal impact on the LARSE active experiment itself.

Immediately following the completion of the active phase of LARSE II, all the PBIC equipment, along with a sizeable portion of the PASSCAL equipment was transported to Twenty-Nine Palms for the Hector Mines RAMP deployment. The PBIC and PASSCAL equipment was then fully utilized for the month of November. PBIC personnel played critical roles in the deployment, maintenance and retrieval of both the Bullion Wash (BWA) and Bullion Mountain (BMA) arrays including coordinating field activities during the maintenance phase of the deployment. A timeline of the Hector Mines Bullion Wash Array deployment is shown in figure 2.

In early December, after the retrieval of the equipment from 29 Palms, Javier Favella (Caltech) used one recorder to help resolve some amplitude and response problems seen in the portable data collected last year during the Millikan building response project. Figure 1 shows a map of PBIC deployments in 1999.

The following table summarizes the projects that used PBIC equipment this year.

Dates	**Institution**	**PI(s)**	**Experiment**
01/01/98-current	UCSB	Steidl	Portable Borehole Study
12/06/99-01/05/00	Caltech	Favella/Heaton	Millikan Shake
06/10/98-10/99	CSUN	Simila	Santa Cruz
10/26/99-12/02/99	SCEC	Steidl/Li	Hector Mines RAMP
10/03/98-05/01/99	UCLA	Kohler/Davis	LARSE II (passive)
10/14/99-10/26/99	SCEC	Fuis/Okaya	LARSE II (active)

Telemetry

The ARGOS satellite telemetry system was deployed at one of Dr. Steidl's stations as part of the portable borehole study. Software was setup on the web that allowed near realtime observation of the status of the station. This system was also used during the Hector Mines RAMP deployment on the southern array to track the number of events recorded and the system's battery level. This gave deployment teams a general indication of the power status of the stations and when batteries might need to be replaced.

Sensor Calibration

Some new work was done on the instrument response calibration system. The purpose was to simplify the calibration of network–recorded calibration pulses using the method originally designed by the PBIC for data collected on the portable recorders. Much of this work was documenting the steps needed to get calibration file and directory structures into the right format for continued processing. Two separate groups used this "mid-stream processing" information in calibration projects.

Hardware: Management, Development, Repair and Quality Control

Caltech supplemented the PBIC inventory by making their two portable systems available for use through the PBIC on a semi-permanent basis. The stations included disk subsystems and FBAs. The disks were immediately upgraded to 1Gb capacity to match the other PBIC systems. The DASs were updated with current firmware and additional static RAM to match the PBIC DASs and minimize power consumption.

Y2K issues prompted a firmware upgrade of all DASs that, although necessary, proved to be uneventful. The PBIC GPS units were also upgraded with hardware modifications and firmware changes to take care of WNRO and Y2K issues. This was a somewhat involved process that created some new bugs that first showed up during the LARSE II active deployment on several PBIC GPS systems. After intervals varying between several days and a week of normal operation, the GPS would power down at the end of its normal cycle but never power back up. Cycling the power input to the GPS restores operation. This problem is still under investigation.

A current inventory of PBIC equipment is shown in Table 1.

Computational Support: Web and Software Development

The PBIC web page access nearly doubled this past year, being accessed 14384 times by 1501 users in the last 12 months. The PBIC has started adding information about equipment history and status to the web pages and hopes to have a database driven system before the end of next year.

Major software development this past year was minimal, but many refinements were made to existing software and scripts.

Outreach

The PBIC remained active in outreach programs, giving two presentations to local schools in association with ICS personnel in the past year, and providing additional resources for two other presentations by UCSB Geology personnel.

Another outreach program, run in conjunction with the SCEC Borehole Initiative, has proven very popular. PC-compatible computers running RedHat Linux were

placed in three schools where borehole seismometers have been installed. The program's web site (http://www.crustal.ucsb.edu/scec/outreach), maintained at the Institute for Crustal Studies, has had 10667 accesses by 1200 different users. There have been some minor hardware related issues, but those have been resolved. There are still plans to get near real-time seismic information from the on–site borehole sensors onto the display.

Publications

The following publications reference data collected using the PBIC equipment.

FUIS, G.S., CRILEY, E.E., MURPHY, J.M., PERRON, J.T., YONG, A., U.S. Geological Survey, Menlo Park, CA 94025, fuis@usgs.gov; BENTHIEN, M.L., BAHER, S.A., CLAYTON, R.W., DAVIS, P.M., GODFREY, N.J., HENYEY, T.L., KOHLER, M.D., MCRANEY, J.K., OKAYA, D.A., Southern California Earthquake Center, University of Southern California, Los Angeles, CA 90089-0742, benthien@terra.usc.edu; SIMILA, G., California State University, Northridge, CA 91330-8266, gsimila@csun.edu; KELLER, G.R., University of Texas, El Paso, TX 79968-0555, keller@geo.utep.edu; PRODEHL, C., Karlsruhe University, Karlsruhe, 76187 Germany, cprodehl@gpiwap1.physik.uni-karlsruhe.de; RYBERG, T., GeoForschungsZentrum, Potsdam, 14473 Germany, trond@gfz-potsdam.de; THYBO, H., University of Copenhagen, Copenhagen, DK 1350, ht@seis.geol.ku.dk; TEN BRINK, U.S., U.S. Geological Survey, Woods Hole, MA 02543, utenbrink@nobska.er.usgs.gov. The Los Angeles Region Seismic Experiment, Phase II (LARSE II)--A Survey to Identify Major Faults and Seismic Hazards Beneath a Large Urban Region. Seismological Research Letters, in press, 2000.

Kohler, M. D., B. C. Kerr, and P. M. Davis, The 1997 Los Angeles Region Seismic Experiment - a dense, urban seismic array to investigate basin lithospheric structures, U.S. Geological Survey Open-File Report, submitted, 2000 SCEC contribution number 498.

Steidl, J. H., R. J. Archuleta, and L. F. Bonilla (1999). Application of site characterization studies to ground motion prediction: Analysis of vertical array data from well characterized sites in California, Seismological Research Letters, 70, p. 251.

Steidl, J. H., L. F. Bonilla, and R. J. Archuleta (1999). Ground motion prediction using site characterization data and borehole instrumentation, American Geophysical Union Transactions, 80, p. 700.

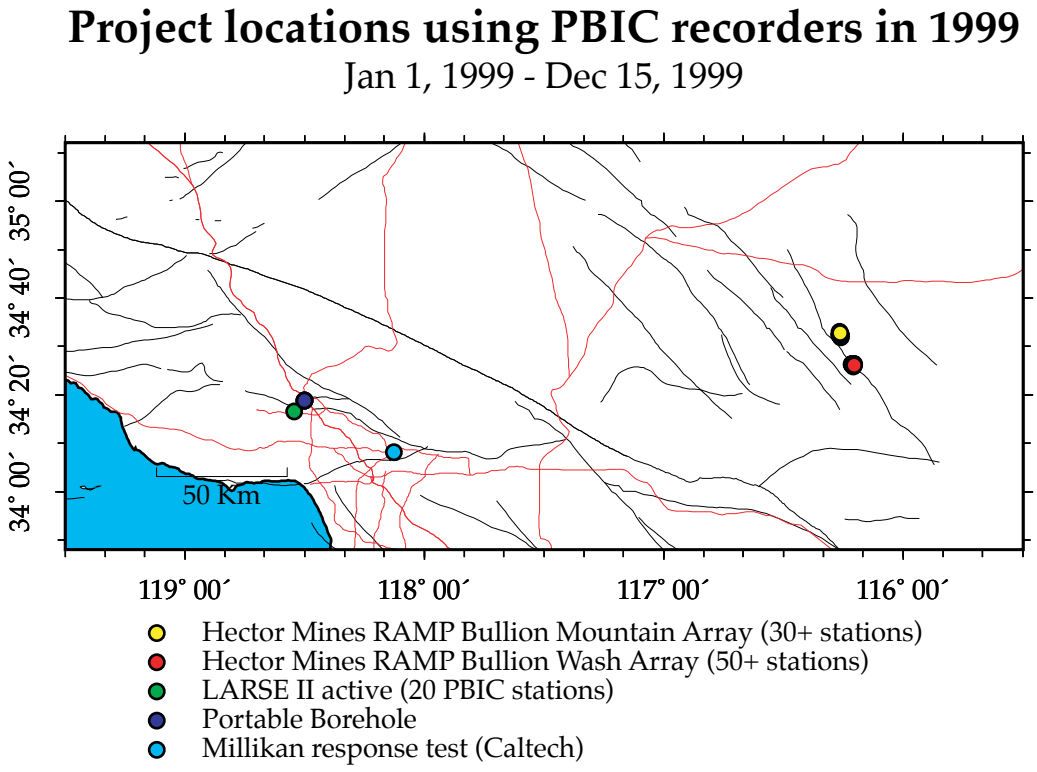
Table 1:

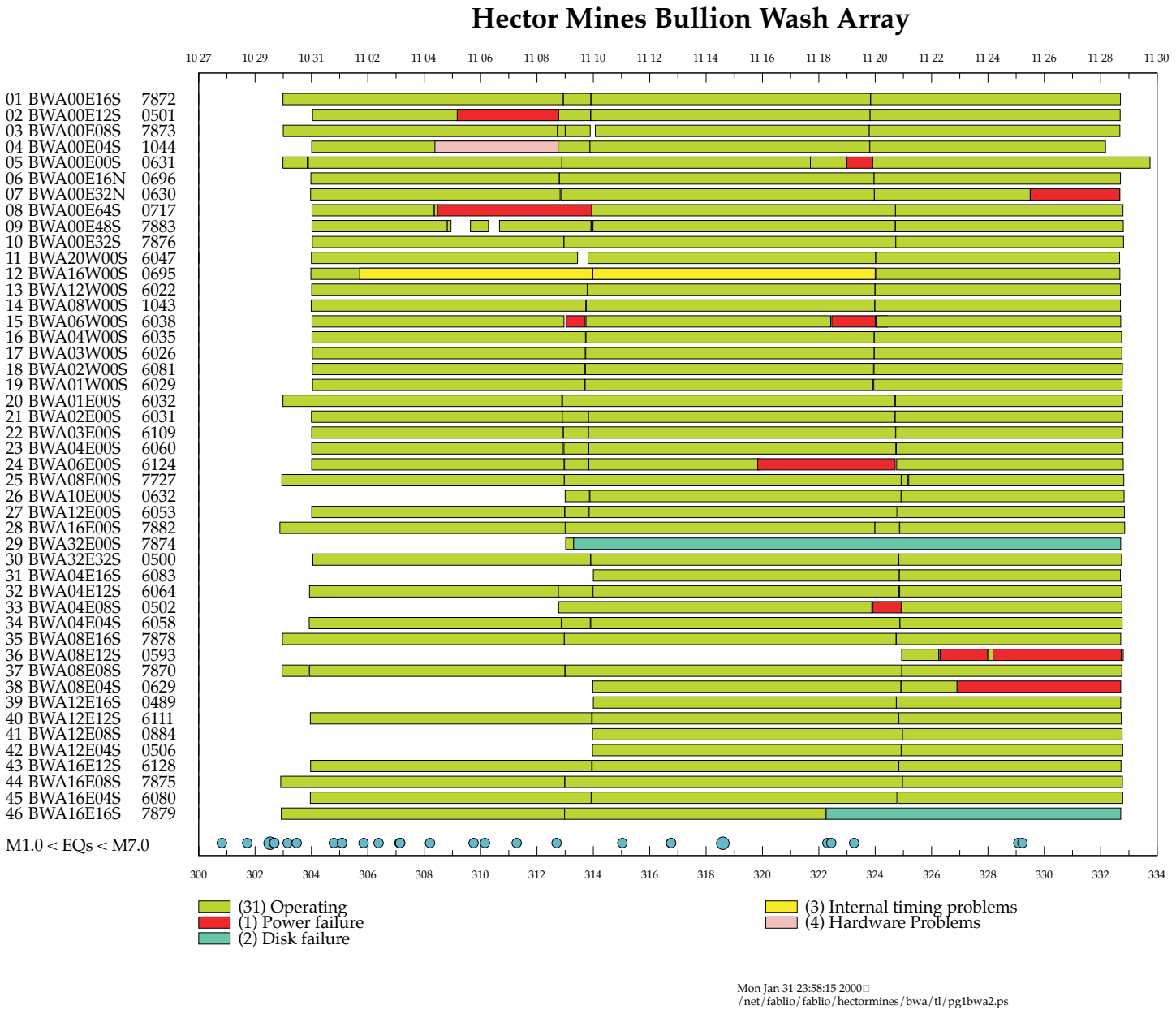
Equipment Inventory

The following table outlines the PBICs current major equipment inventory. Various subsystems, such as AC power and solar power, are not listed.

Qty.	Model	Description
9	72A-02	16 bit data acquisition system (DAS)
11	72A-08	16/24 bit data acquisition system (DAS)
26	72A-05/PBIC	External hard disk subsystems (1Gb)
20	111A	GPS units
18	L4C3D	1Hz velocity transducer
18	FBA23	Force Balance Accelerometer
5	CMG40T	Intermediate period 3 component sensor
2		CMG40T interface/calibration unit
2	72A-03	Portable exabyte tape system
1		Portable DAT tape system
2		2-4 Gb Portable Data transfer disk
4		Zeos style palmtop computer
4		HP style palmtop computer

Figure 1:




Hector Mines Bullion Wash Array
10 27
10 29
10 31
11 02
11 04
11 06
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11 10
11 12
11 14
11 16
11 18
11 20
11 22
11 24
11 26
11 28
11 30
01 BWA00E16S 7872
02 BWA00E12S 0501
03 BWA00E08S 7873
04 BWA00E04S 1044
05 BWA00E00S 0631
06 BWA00E16N 0696
07 BWA00E32N 0630
08 BWA00E64S 0717
09 BWA00E48S 7883
10 BWA00E32S 7876
11 BWA20W00S 6047
12 BWA16W00S 0695
13 BWA12W00S 6022
14 BWA08W00S 1043
15 BWA06W00S 6038
16 BWA04W00S 6035
17 BWA03W00S 6026
18 BWA02W00S 6081
19 BWA01W00S 6029
20 BWA01E00S 6032
21 BWA02E00S 6031
22 BWA03E00S 6109
23 BWA04E00S 6060
24 BWA06E00S 6124
25 BWA08E00S 7727
26 BWA10E00S 0632
27 BWA12E00S 6053
28 BWA16E00S 7882
29 BWA32E00S 7874
30 BWA32E32S 0500
31 BWA04E16S 6083
32 BWA04E12S 6064
33 BWA04E08S 0502
34 BWA04E04S 6058
35 BWA08E16S 7878
36 BWA08E12S 0593
37 BWA08E08S 7870
38 BWA08E04S 0629
39 BWA12E16S 0489
40 BWA12E12S 6111
41 BWA12E08S 0884
42 BWA12E04S 0506
43 BWA16E12S 6128
44 BWA16E08S 7875
45 BWA16E04S 6080
46 BWA16E16S 7879
M1.0 < EQs < M7.0
300
302
304
306
308
310
312
314
316
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320
322
324
326
328
330
332
334
(31) Operating
(1) Power failure
(2) Disk failure
(3) Internal timing problems
(4) Hardware Problems
Mon Jan 31 23:58:15 2000
/net/fablio/fablio/hectormines/bwa/tl/pg1bwa2.ps

Figure 2: