

**ANNUAL TECHNICAL REPORT**

**Urban and Regional Seismic Monitoring—Wasatch Front Area, Utah,  
and Adjacent Intermountain Seismic Belt**

**Year One: January 1 – December 31, 2001**

U.S. Geological Survey Cooperative Agreement No. 01HQAG0014

Dr. Walter J. Arabasz, Principal Investigator  
Dr. Robert B. Smith, Co-Principal Investigator  
Dr. James C. Pechmann, Co-Investigator  
Susan J. Nava, Co-Investigator

University of Utah  
Department of Geology and Geophysics  
135 South 1460 East, Room 705 WBB  
Salt Lake City, UT 84112-0111  
Tel: (801) 581-6274 Fax: (801) 585-5585  
E-mail: arabasz@seis.utah.edu  
URL: www.seis.utah.edu

USGS Project Officer: Dr. John Unger  
USGS Administrative Contracting Officer: Sherry Ly Newman

Program Element: Seismic Networks  
Key Words: Regional Seismic Hazards, Real-time Earthquake Information,  
Seismotectonics, Engineering Seismology

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**W. J. Arabasz, R. B. Smith, J. C. Pechmann, and S. J. Nava**

University of Utah  
Department of Geology and Geophysics  
135 South 1460 East, Room 705 WBB  
Salt Lake City, UT 84112-0111  
Tel: (801) 581-6274 Fax: (801) 585-5585  
E-mail: arabasz@seis.utah.edu  
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Seismotectonics, Engineering Seismology

**Non-technical Summary  
January 1 – December 31, 2001**

This cooperative agreement provides major support for urban and regional seismic monitoring in the study area. It also helps support the operation of a regional earthquake-recording and information center. During 2001 we completed the second stage of developing a new real-time earthquake information system in Utah's Wasatch Front urban corridor as part of an Advanced National Seismic System (ANSS). We added 20 more urban stations, five high-quality regional stations, new computer systems, and a capability to automatically generate computer maps of the severity of ground shaking within minutes of an earthquake. Nearly 4,300 seismic events were located by the regional seismic network in our Utah study region during the report period; thirteen had a magnitude of 3.0 or larger, and eleven were reported felt.

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**Summary**

**January 1 – December 31, 2001**

This cooperative agreement, combined with funding from the State of Utah, provides major support for network operations associated with the University of Utah's urban/regional seismic network (156 stations at the end of 2001). USGS support focuses on the seismically hazardous Wasatch Front urban corridor of north-central Utah but also encompasses neighboring areas of the Intermountain Seismic Belt. Primary objectives of this USGS support are the continuous seismic monitoring of the study area and the services of a regional earthquake-recording and information center

A major advance in modernizing the University of Utah's seismic network began in FY2000 as part of the local implementation of an Advanced National Seismic System (ANSS). Under the ANSS initiative, the USGS and the University of Utah worked toward the goal of building a basic real-time earthquake information system in Utah's rapidly-growing Wasatch Front urban corridor (encompassing Salt Lake City, Provo, and Ogden) by the end of 2001—before the 2002 Salt Lake City Winter Olympics. During the summer and fall of 2001, twenty strong-motion stations were added to twenty initial stations installed in FY2000. Five new regional broadband stations (including triaxial accelerometers) were also installed to enhance geographic control for ShakeMaps. By the end of 2001, a basic end-to-end real-time monitoring system—including capabilities for automated alerts and ShakeMaps—was nearly complete.

During the report period, we detected and analyzed approximately 8,781 seismic events, including local earthquakes, teleseismic and regional earthquakes, and blasts. A total of 6,489 earthquakes were located in the Intermountain Seismic Belt—including 4,298 within the Utah region, of which 3,992 were within the Wasatch Front region. Thirteen earthquakes of magnitude 3.0 and larger, and two of magnitude 4.0 and larger, occurred in the Utah region

during the report period. The largest seismic event was a shock of magnitude ( $M_L$ ) 4.2 that occurred at 20:15 UTC on July 19, 2001, 46 km east of Richfield in south-central Utah.

In addition to fulfilling responsibilities for routine network operations and earthquake data processing, and beyond major efforts in building the new urban strong-motion network, notable accomplishments (and related efforts) during the project period included: (1) recalibration of coda magnitudes in our earthquake catalog from 1981 to present, (2) significant upgrading of our Earthworm data acquisition/processing system and advancing of real-time integration with other networks; and (3) organizing state and regional stakeholders as part of implementing the management structure of an Advanced National Seismic System in Utah and the Intermountain West Region.

## TABLE OF CONTENTS

|   |     |
|---|-----|
| <b>NON-TECHNICAL SUMMARY</b>  | ii  |
| <b>SUMMARY</b>  | iii |
| <b>INTRODUCTION</b>   | 1   |
| General Background  | 1   |
| Hazard, Risk, and Benefits to NEHRP of this State-Federal Partnership | 1   |
| Regional Seismic Network  | 2   |
| <b>RESULTS AND ACCOMPLISHMENTS</b>                                    | 5   |
| Overview of Seismicity  | 5   |
| Real-Time Urban Strong-Motion Monitoring                              | 10  |
| Accomplishments in Ongoing Network Operations                         | 11  |
| Recalibration of coda magnitudes in Utah catalog, 1981–present        |     |
| Near-real-time integration with other networks                        |     |
| Assistance to other networks in the Intermountain West Region         |     |
| Archiving waveform data   |     |
| CNSS earthquake catalog   |     |
| Coal-mining-induced seismicity  |     |
| <b>AVAILABILITY OF DATA</b>   | 13  |
| <b>REFERENCES CITED</b>   | 13  |
| <b>REPORTS AND PUBLICATIONS</b>                                       | 14  |
| <b>DISTRIBUTION OF FINAL TECHNICAL REPORT</b>                         | 26  |

## INTRODUCTION

This technical report summarizes results and accomplishments under this cooperative agreement during the period January 1–December 31, 2001.

### **General Background**

This cooperative agreement, combined with funding from the State of Utah, provides major support for network operations associated with the University of Utah's urban/regional seismic network (156 stations at the end of 2001). Ongoing USGS support focuses on the seismically hazardous Wasatch Front urban corridor of north-central Utah and also encompasses neighboring areas of the Intermountain Seismic Belt (ISB). Under the local implementation of an Advanced National Seismic System (ANSS), we continued development of a real-time urban strong-motion network in the Wasatch Front area. The real-time responsiveness and the strong-motion aspects of the network upgrading represented a major advance towards meeting local user needs for emergency response, earthquake engineering, and science. (The siting of the 2002 Winter Olympics in and near Salt Lake City provided a secondary motivation for developing capabilities for real-time seismic monitoring in a timely way.)

Primary deliverables for this USGS support are the continuous seismic monitoring of the study area and the services of a regional earthquake recording and information center. Information products and services include rapid earthquake alert, a modern Web site with near-real-time earthquake information, earthquake catalogs (issued on a quarterly basis in preliminary form and periodically in finalized form), automated transfer of hypocentral, waveform, and arrival-time data to other outlets prescribed by the USGS for broad access, and extensive expert assistance to individuals and groups in earthquake education and awareness, public policymaking, planning and design, and hazard and risk assessment.

Scientific objectives include the characterization of tectonic framework and earthquake potential, surveillance of space-time seismicity and characteristics of small-to-moderate earthquakes (for understanding the nucleation of large earthquakes in the region), and the documentation and evaluation of various earthquake-related parameters for accurate hazard and risk analyses. Scientific results are routinely reported to the USGS under separate research awards.

### **Hazard, Risk, and Benefits to NEHRP of this State-Federal Partnership**

Earthquakes pose the greatest natural threat for destruction of life and property in Utah. On a national level, the relative hazard and risk in Utah's densely populated Wasatch Front area led the USGS to target this area for an urban strong-motion network of 500 instruments in its 1999 report to Congress for an Advanced National Seismic System (ANSS) (USGS Circular 1188). The Federal Emergency Management Agency (FEMA) ranks Utah seventh in the Nation in absolute risk and sixth in relative risk when one takes the ratio of the average annualized earthquake loss to the replacement value of the building inventory (FEMA, 2000).

More than three-quarters of Utah's population and economy are concentrated in the Wasatch Front area, literally astride the five most active segments of the Wasatch fault. Population in the Ogden-Salt Lake City-Provo urban corridor is growing dramatically from its 1995 base of 1.6 million and is projected to reach 2.7 million by 2020 and 5 million by 2050.

The Wasatch Front area occupies an active segment of the ISB—roughly centered on the 343-km-long Wasatch fault zone. Diffuse shallow seismicity, Holocene normal faulting, and episodic surface-faulting earthquakes of M6.5 to M7.5+ characterize the area. The Wasatch fault is notable as the longest continuous, active normal fault in the United States (10 discrete segments)—with five central segments between Brigham City and Nephi (see Figure 2) having an average length of about 50 km, Holocene slip rates of 1-2 mm/yr, and average recurrence intervals ranging from about 1,300 to 2,800 yr (Machette et al., 1991; McCalpin and Nishenko, 1996). One of the most active segments is the Salt Lake City segment, which has produced large, M~7, surface-faulting earthquakes on the average of once every 1,350 ± 200 years during the past 6,000 years, with the last one occurring 1,230 ± 60 years ago (Black et al., 1995; McCalpin and Nishenko, 1996; McCalpin and Nelson, 2000).

The National Seismic Hazard Maps of Frankel et al. (1996, gridded data) indicate relatively high ground-shaking hazard for the Wasatch Front—reflected, for example, by the following values of peak ground acceleration in the Salt Lake Valley for specified probabilities of exceedance: 0.30 g (10% in 50 yr), 0.53 g (5% in 50 yr), 0.87 g (2% in 50 yr). Expected direct economic losses to buildings and lifelines for a scenario M7.5 earthquake centered in Salt Lake County are approximately \$12 (±3) billion (Rojahn et al., 1997). The addition of indirect economic and social losses would lead to higher total loss.

Both NEHRP and the USGS derive great benefit from this project in the form of (1) significant cost-sharing by the state of Utah under this state-federal partnership and (2) wide-ranging activities by University of Utah seismologists which effectively relieve the USGS from having to meet the same first-order needs in this region. Importantly, the combined state-federal funding allows balance between the practical necessities of a *regional* seismological approach and careful attention to Utah's urban corridor.

### **Regional Seismic Network**

Figures 1 and 2 together with Table A-1 (Appendix A) summarize essential information for the University of Utah's urban/regional seismic network, which included 156 stations at the end of the report period. The locations of conventional broadband and short-period stations forming the regional network are shown in Figure 1. Figure 2 shows the location of strong-motion stations installed by the end of 2001 as part of the new urban network. During 2001, five broadband stations (including triaxial strong-motion sensors) were added in northern Utah, strategically complementing stations of the U. S. National Seismograph Network (USNSN) and resulting in a broadband station spacing less than 100 km in the Wasatch Front area (Figure 1).

# University of Utah Regional Seismic Network December 2001

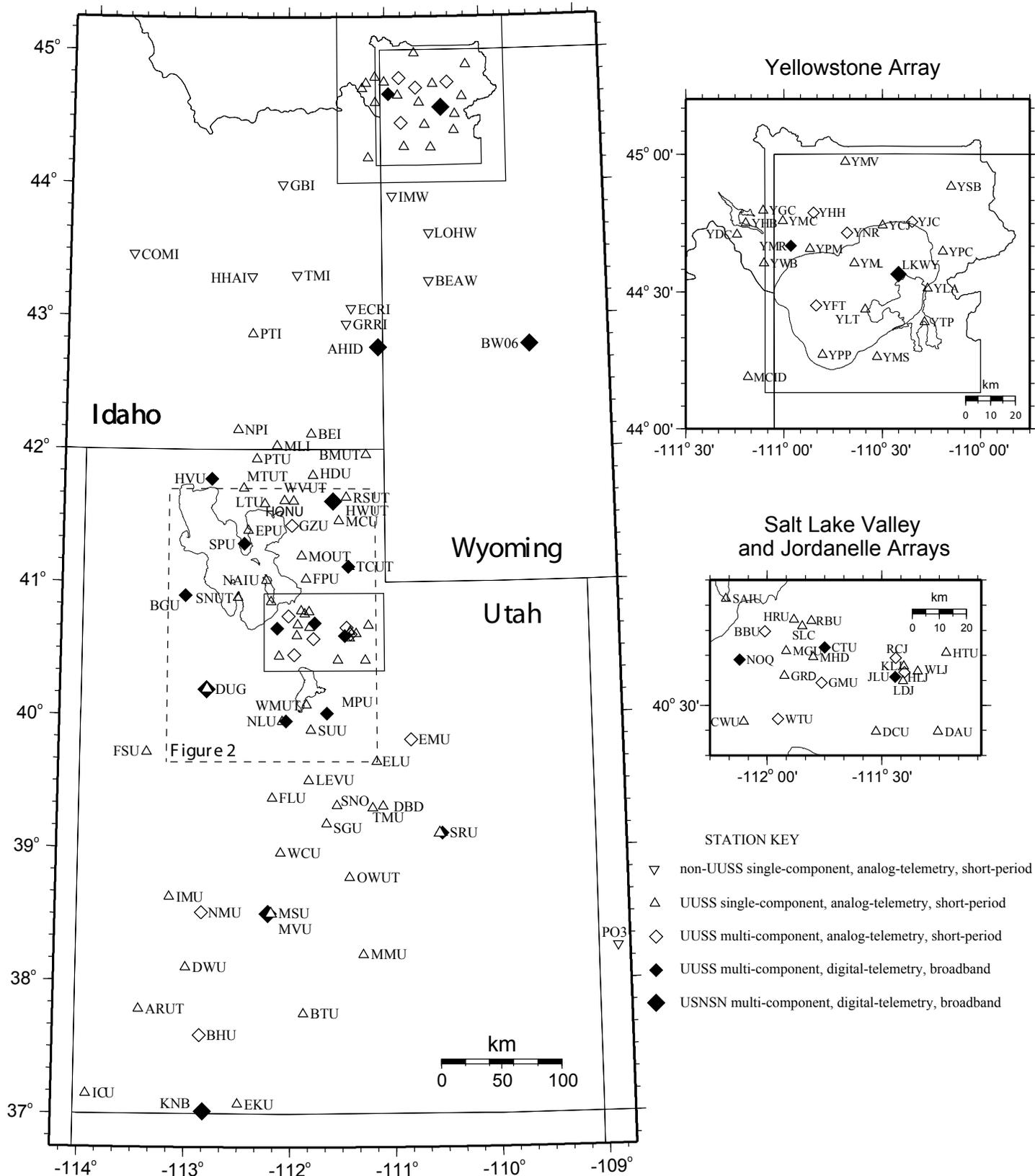
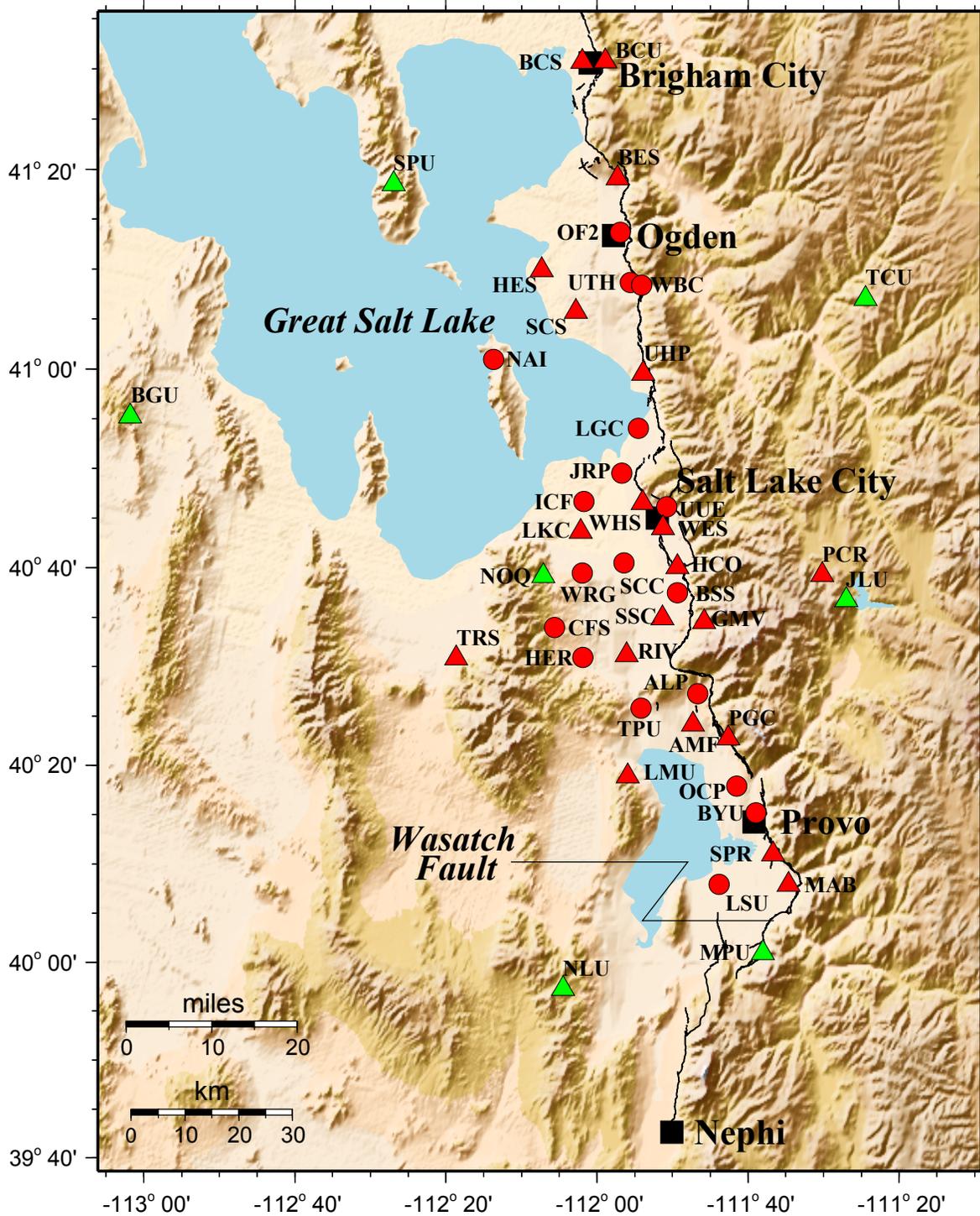


Figure 1

# UUSS/ANSS Real-Time Strong-Motion Network Wasatch Front, Utah (December 2001)



Key:

|                                     |        |        |
|-------------------------------------|--------|--------|
|                                     | FY2000 | FY2001 |
| Strong-Motion Station               | ●      | ▲      |
| Strong-Motion <u>plus</u> Broadband |        | ▲      |

Figure 2

The urban/regional network consists of 87 stations focused on the Wasatch Front area, an additional 33 stations that provide expanded coverage of the Utah region (chiefly central and southwestern Utah), and another 36 stations covering the continuation of the Intermountain Seismic Belt from south-central Idaho to Yellowstone National Park (separate USGS support is provided for the Yellowstone network). As indicated in Table A-1 (Appendix A), during the period of this award 23 of the 156 stations were maintained by other institutions—six by the Idaho National Engineering and Environmental Laboratory and eleven by the USGS as part of the USNSN. The University of Utah handled the field repair and maintenance of 133 stations, 85 of which were sponsored by the USGS under this award.

## **RESULTS AND ACCOMPLISHMENTS**

### **Overview of Seismicity**

During the report period, we detected and analyzed approximately 8,781 seismic events. Of these 49 percent were local earthquakes in the Utah region, 36 percent were regional earthquakes and teleseisms, and 15 percent were blasts. A total of 6,489 earthquakes were located in the Intermountain Seismic Belt, including 4,298 within the Utah region (Figure 3) and 3,992 within our standard Wasatch Front region (38° 55'–42° 30' N, 110° 25'–113° 10' W). Thirteen earthquakes of magnitude 3 or larger occurred in the Utah region, including spatially and temporally clustered events in southwestern Utah (Figure 4, Table 2). The largest earthquake during the report period was a shock of magnitude ( $M_L$ ) 4.2 that occurred in south-central Utah on July 19, 2001, at 20:15 UMT, 46 km east of Richfield (Figure 4).

Eleven earthquakes in the Utah region during the report period were documented as felt (Table 2). The University of Utah Seismograph Stations issued eight press releases during the report period immediately after earthquakes in the Utah region that were either felt by many or larger than a set threshold magnitude of 3.5. About 84 percent of the seismicity detected in the Utah region during the report period was associated with areas of ongoing coal-mining-related seismicity in east-central Utah and included 3,621 shocks ( $M < 3.0$ ) located within an arcuate zone extending counterclockwise from immediately north of Price to 100 km southwest of it (Figure 3).

# Seismicity of the Utah Region January 1–December 31, 2001

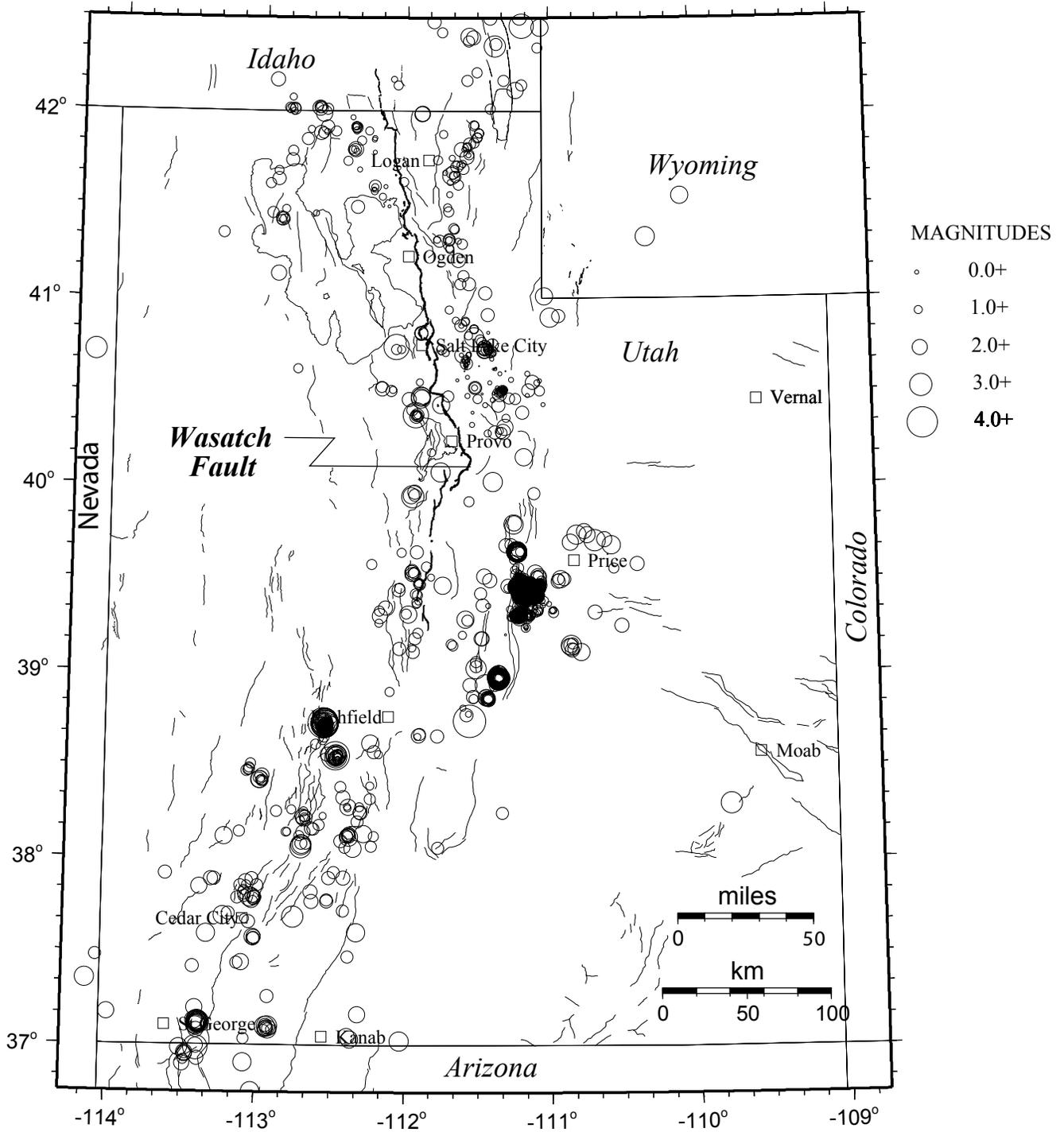


Figure 3. Earthquake epicenters (N=4,298) located by the University of Utah Seismograph Stations, superposed on a map of Quaternary (geologically young) faults compiled by the Utah Geological Survey. The Wasatch fault is shown in bold.

# Earthquakes of Magnitude 3.0 and Larger January 1–December 31, 2001

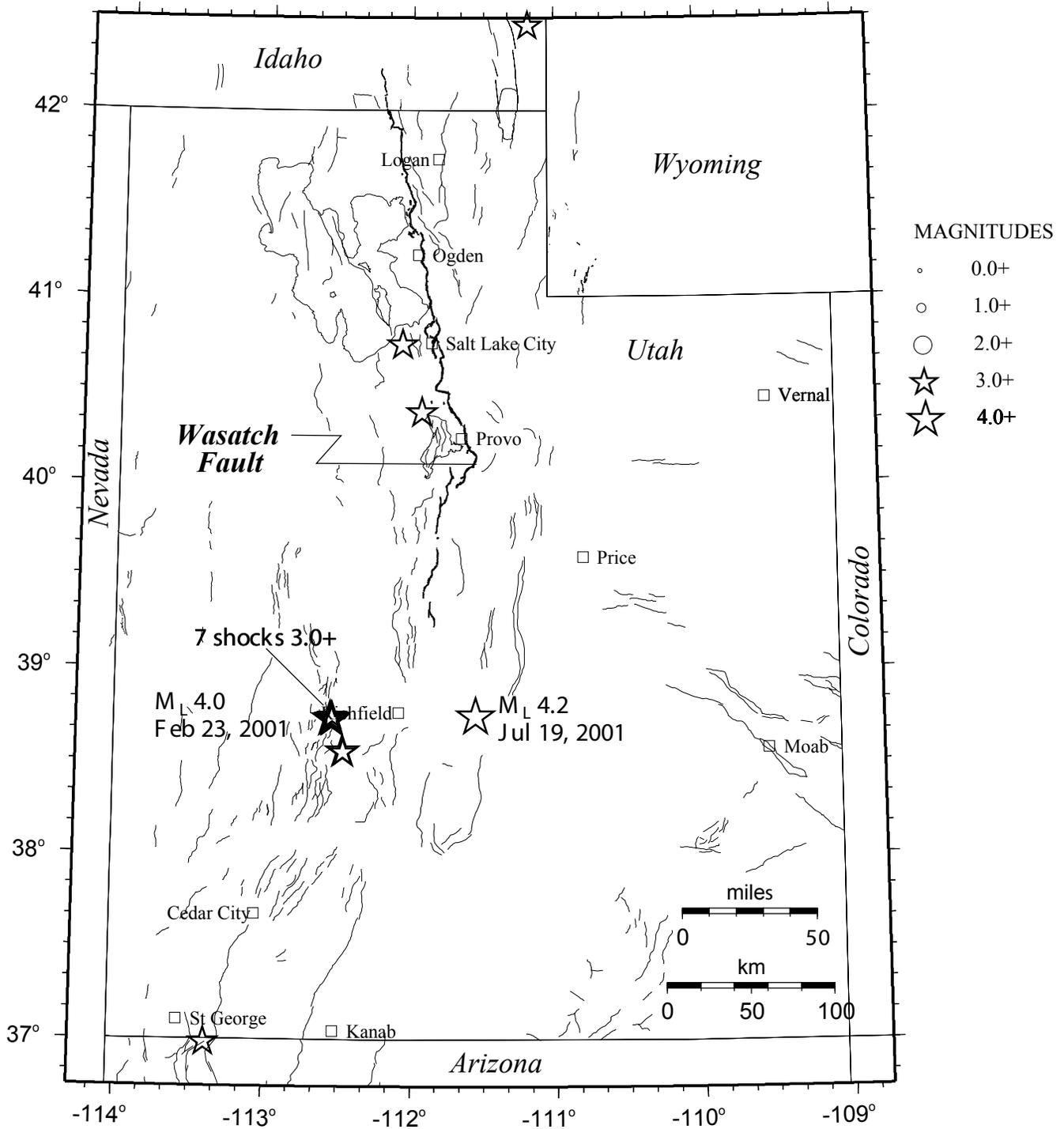


Figure 4. Epicenter map of 13 shocks of magnitude 3.0 and larger in the Utah Region during the period January 1–December 31, 2001 (see Table 1). Two earthquakes of magnitude 4.0 and larger are specially labeled. Base map as in Figure 3.

**Table 1**  
**Earthquakes in the Utah Region of Magnitude 3.0 and Larger, 2001**

| <i>date</i> | <i>orig time</i> | <i>latitude</i> | <i>longitude</i> | <i>depth</i> | <i>mag</i> | <i>no</i> | <i>gap</i> | <i>dmn</i> | <i>rms</i> |
|-------------|------------------|-----------------|------------------|--------------|------------|-----------|------------|------------|------------|
| 010210      | 1056 15.23       | 38° 43.02'      | 112° 32.79'      | 0.9          | 3.4W       | 19        | 67         | 35         | 0.30       |
| 010223      | 2143 50.82       | 38° 43.62'      | 112° 33.33'      | 1.1          | 4.0W       | 17        | 68         | 35         | 0.34       |
| 010224      | 1054 40.75       | 38° 43.59'      | 112° 32.66'      | 2.0          | 3.6W       | 18        | 68         | 35         | 0.37       |
| 010224      | 1055 48.74       | 38° 44.51'      | 112° 32.52'      | 1.3          | 3.0W       | 8         | 127        | 37         | 0.36       |
| 010228      | 0409 46.14       | 38° 43.30'      | 112° 32.78'      | 0.2          | 3.6W       | 14        | 67         | 35         | 0.23       |
| 010313      | 01343 4.06       | 38° 43.41'      | 112° 32.59'      | 0.7          | 3.3W       | 17        | 68         | 35         | 0.32       |
| 010509      | 01013 3.97       | 38° 44.07'      | 112° 32.78'      | 0.7          | 3.5W       | 14        | 68         | 36         | 0.33       |
| 010520      | 1035 58.31       | 36° 59.11'      | 113° 23.15'      | 0.0          | 3.2W       | 11        | 208        | 51         | 0.48       |
| 010524      | 0240 40.89       | 40° 22.56'      | 111° 55.94'      | 6.4          | 3.3W       | 45        | 46         | 7          | 0.34       |
| 010708      | 1355 51.32       | 40° 44.48'      | 112° 04.32'      | 11.1         | 3.4W       | 55        | 68         | 5          | 0.26       |
| 010719      | 2015 33.79       | 38° 44.44'      | 111° 33.36'      | 0.1          | 4.2W       | 22        | 90         | 12         | 0.18       |
| 010831      | 1214 52.22       | 42° 27.40'      | 111° 11.26'      | 0.8          | 3.1W       | 24        | 108        | 35         | 0.26       |
| 011119      | 2136 24.99       | 38° 33.04'      | 112° 28.20'      | 0.7          | 3.7W       | 21        | 50         | 33         | 0.34       |

number of earthquakes = 13

\* indicates poor depth control

W indicates Wood-Anderson data used for magnitude calculation

**Table 2**  
**Felt Earthquakes in the Utah Region**  
**January 1 to December 31, 2001**

| <b>Date</b>      | <b>Time†</b>            | <b>Felt Information*</b>  | <b>Latitude</b> | <b>Longitude</b> | <b>Magnitude§</b>   |
|------------------|-------------------------|---|-----------------|------------------|---------------------|
| Feb 13<br>Feb 12 | 01:40<br>6:40 p.m. MST  | Montpelier, Bern, and Paris, ID                                       | 42° 20.92'      | 111° 22.74'      | M <sub>L</sub> 2.88 |
| Feb 23<br>Feb 22 | 04:56<br>9:56 p.m. MST  | Payson, Spanish Fork, and Salem, UT                                   | 40° 04.22'      | 111° 45.47'      | M <sub>L</sub> 2.49 |
| Feb 23           | 21:43<br>2:43 p.m. MST  | Richfield and Cove Fort, UT   | 38° 43.62'      | 112° 33.33'      | M <sub>L</sub> 4.02 |
| Mar 7<br>Mar 6   | 05:48<br>10:48 p.m. MST | Mount Carmel Jct. and Springdale, UT                                  | 37° 05.96'      | 112° 55.48'      | M <sub>C</sub> 2.71 |
| May 24<br>May 23 | 02:40<br>8:40 p.m. MDT  | Lehi, Saratoga Springs, and Cedar Hills, UT                           | 40° 22.56'      | 111° 55.94'      | M <sub>L</sub> 3.31 |
| Jun 6<br>Jun 5   | 03:56<br>9:56 p.m. MDT  | Park City, Salt Lake City, and Brighton, UT                           | 40° 41.89'      | 111° 36.18'      | M <sub>L</sub> 2.36 |
| July 8           | 13:55<br>07:55 a.m. MDT | Magna, Kearns, West Valley City, Hunter, Salt Lake Airport, Rose Park | 40° 44.48'      | 112° 04.32'      | M <sub>L</sub> 3.36 |
| July 19          | 20:15<br>02:15 p.m. MDT | 1-70 Mile post 82: East of Richfield, UT                              | 38° 44.44'      | 111° 33.36'      | M <sub>L</sub> 4.22 |
| Oct 3            | 08:25<br>01:25 a.m. MST | Cedar City, UT  | 37° 46.58'      | 113° 01.70'      | M <sub>C</sub> 2.20 |
| Oct 3            | 08:31<br>01:31 a.m. MST | Cedar City, UT  | 37° 47.05'      | 113° 02.48'      | M <sub>L</sub> 2.53 |
| Nov 19           | 21:36<br>02:36 p.m. MST | West of Sevier, UT  | 38° 33.04'      | 112° 28.20'      | M <sub>L</sub> 3.70 |

† Times are listed first as UTC, then as Local Time.

\* Felt information as reported to the University of Utah Seismograph Stations unless otherwise noted.

§ Local magnitude (M<sub>L</sub>) from University of Utah (UUS)S)

## Real-Time Urban Strong-Motion Monitoring

Under the ANSS initiative, the USGS and the University of Utah began cooperatively working in FY2000 toward the goal of building a basic real-time earthquake information system in Utah's rapidly-growing Wasatch Front urban corridor (encompassing Salt Lake City, Provo, and Ogden) by the end of 2001—before the 2002 Salt Lake City Winter Olympics. The primary motivation was to improve earthquake information in this area for emergency response and long-term risk reduction; the timing of the 2002 Winter Olympics added a secondary motivation for developing capabilities for real-time seismic monitoring in a timely way. Twenty strong-motion stations (Kinometrics K2s with EpiSensors) were installed in FY2000 at 15 urban reference sites, four free-field rock sites, and 1 free-field soil site (see Figure 2 and Arabasz et al., 2000). In FY2001, the following were accomplished:

- ShakeMap software was implemented with the collaborative involvement of the USGS, the Utah Geological Survey, and the Utah Division of Comprehensive Emergency Management (Pankow et al., 2001; Ashland, 2001; ShakeMaps were successfully created for two local earthquakes, each of magnitude 3.4, on May 23 and July 8, 2001—see <<http://www.seis.utah.edu/shake>>);
- 20 additional strong-motion stations (also K2s with EpiSensors) were installed in the Wasatch Front urban corridor at 16 urban-reference sites and four free-field rock sites (see Figure 2), continuing the practice started in FY2000 of using a combination of frame-relay telephone, spread-spectrum radio, and public Internet for continuous, real-time telemetry;
- 5 new regional broadband stations (REF TEK 6-channel 24-bit data loggers with CMG-3ESP broadband seismometers and companion EpiSensor accelerometers) were installed in the broader Wasatch Front area (see Figure 2) to enhance geographic control for ShakeMaps;
- to assist others with ANSS strong-motion installations, we wrote and made available on the Web a well-received installation guide that describes many practical details learned from our experience (see <[http://www.seis.utah.edu/urban/SM\\_installation\\_manual/Strong\\_Motion\\_Network.htm](http://www.seis.utah.edu/urban/SM_installation_manual/Strong_Motion_Network.htm)>);
- a homepage was developed on our Web site summarizing general information and abundant details for stakeholders and users of our new urban strong-motion network (see <<http://www.seis.utah.edu/urban/index.shtml>>);
- at the University of Utah's regional earthquake-recording center, "Earthworm" computer systems (hardware and software) designed for real-time earthquake monitoring and automated alert were extensively upgraded and expanded with joint USGS-University of Utah funding and efforts;
- in June 2001, we organized a half-day meeting in Salt Lake City for stakeholders interested in Utah's new infrastructure for urban strong-motion monitoring and rapid post-earthquake response (about 40 people attended);
- in July 2001, a 12-member state-level advisory committee was created, both as part of the ANSS management structure and as part of Utah's state earthquake program, to guide the development and effective use of urban strong-motion monitoring in Utah; and

- in July-August 2001, extensive efforts were made to develop an ANSS implementation plan for FY2002—both for the state of Utah and for the Intermountain West (IMW) Region as a whole (see Arabasz and IMW Working Group, 2001).

### **Accomplishments in Ongoing Network Operations**

All responsibilities for network operations and earthquake data processing were fulfilled for the report period. Four quarterly epicenter bulletins for the Utah region were compiled and distributed.

Besides routine operations, notable accomplishments during the report period included: (1) recalibration of the coda-magnitude scale used in the Utah earthquake catalog, 1981 to present; (2) advancing real-time integration with—and providing technical help to—other networks in our region; (3) efficient submission of waveform data from our network to the IRIS Data Management Center (DMC) in SEED format and catalog data to the CNSS earthquake catalog; and (4) companion monitoring and study of mining-induced seismicity for hazard mitigation. The following descriptions provide more detail:

- *Recalibration of coda magnitudes in Utah catalog, 1981–present* — We have calibrated a new equation for calculating coda magnitude ( $M_C$ ) from signal duration and epicentral distance for earthquakes recorded digitally in the Utah region from 1981 to present (Pechmann et al., 2000, 2001). The new  $M_C$  equation was calibrated against local magnitudes ( $M_L$ ) determined from paper and synthetic Wood-Anderson records, using data from 442 earthquakes (1 #  $M_L$  # 4). The use of this equation, together with gain corrections and other corrections applied to the duration measurements, reduces systematic time-dependent differences between  $M_C$  and  $M_L$  from values of up to 0.4 to less than 0.1. The new  $M_C$  equation and  $M_L$  station corrections from a companion study are being used to revise  $M_C$  and  $M_L$  magnitudes in the Utah region for 1981–present.
- *Near-real-time integration with other networks* — During the report period, we continued to expand and enhance the exchange of waveform data in near-real-time with the National Earthquake Information Center, the Idaho National Environmental and Engineering Laboratory, the U.S. Bureau of Reclamation, the Montana Bureau of Mines and Geology, and the University of Nevada, Reno. Data exchange is done via the Internet using Earthworm import/export software modules.
- *Assistance to other networks in the Intermountain West Region* — During the summer of 2001 we provided voluntary technical help to three other networks in our region, including: (1) help to the Montana Regional Seismograph Network in software implementation and in fixing problems at 10 network field sites, especially relating to data telemetry; (2) installation of Earthworm software for recording the Teton Seismograph Network at Brigham Young University-Idaho (formerly Ricks College); and (3) preliminary work on setting up an Earthworm computer system at the Arizona Earthquake Information Center at Northern Arizona University.

- *Archiving waveform data* — All digital waveform data collected by the University of Utah regional seismic network during the report period were submitted to the IRIS DMC in SEED format. (In FY 2000 we completed the massive task of submitting to the IRIS DMC all digital waveform data collected by the University of Utah regional seismic network since January 1, 1981, when digital recording of the network began.) Since mid-June 2000, data from the six UUSS digitally-telemetered broadband stations have been automatically submitted to the IRIS DMC on a daily basis. (During April to August 2001 we worked to resubmit all broadband waveform data provided earlier to the DMC in order to correct an inadvertent coding error in software for converting the data to SEED format). On April 19, 2001, we began submitting continuous data streams to the IRIS DMC from our new real-time strong-motion stations.
- *CNSS earthquake catalog* — During the report period, analyst-reviewed earthquake locations for the Utah (and Yellowstone) regions were automatically submitted to the CNSS catalog four times per day during the Monday–Friday work week.
- *Coal-mining-induced seismicity* — We continued studies of ongoing seismicity ( $M_L$  # 4.2) induced by underground coal mining in east-central Utah (e.g., Arabasz et al., 2001) in order to serve the needs of (1) mining engineers and mine operators concerned with mine safety and (2) decision-makers dealing with the potential hazards of mining seismicity to off-site structures and facilities. In late 2000 we began an instrumentation program and work plan—interrelated with this USGS project in terms of accelerographic recordings and ground-motion modeling—to evaluate the hazard of surface ground shaking caused by mining seismicity in a part of the Wasatch Plateau coal field. The project was formulated jointly with Art McGarr, USGS (Menlo Park), and Jon Ake, U.S. Bureau of Reclamation (Denver); funding is being provided by the State of Utah School and Institutional Trust Lands Administration.

## AVAILABILITY OF DATA

All seismic waveform data archived by the University of Utah Seismograph Stations are available upon request directly from our office (typically delivered to the user in SAC, ASCII, or binary format). Alternatively, waveform data can be retrieved from the IRIS DMC using their SeismiQuery Web tool at <<http://www.iris.washington.edu/SeismiQuery>> (delivered in a variety of formats). Earthquake catalog data for the Utah region are available via anonymous ftp <[ftp.seis.utah.edu: pub/UUSS\\_catalogs](ftp.seis.utah.edu:pub/UUSS_catalogs)>, or by e-mail request to [webmaster@seis.utah.edu](mailto:webmaster@seis.utah.edu), or via the Council of the National Seismic System's composite earthquake catalog, <<http://quake.geo.berkeley.edu/cnss>>. See also the University of Utah Seismograph Stations homepage on the World Wide Web <<http://www.quake.utah.edu>>. The contact person for data requests is Susan J. Nava, Network Manager, tel: (801) 581-6274; e-mail: [nava@seis.utah.edu](mailto:nava@seis.utah.edu).

## REFERENCES CITED

- Arabasz, W. J. and IMW Working Group (2001). FY2002 ANSS Implementation Plan— Intermountain West (IMW) Region, (part of National Implementation Plan for an Advanced National Seismic System), <[www.seis.utah.edu/anss/toc.shtml](http://www.seis.utah.edu/anss/toc.shtml)>, 80 p.
- Arabasz, W. J. and M. K. McCarter (2000). Mine seismicity and the interface between mining engineers and seismologists (abs.), *Seism. Res. Lett.* **71** (2), 220.
- Arabasz, W. J., S. J. Nava, D. C. Cluff, D. L. Drobeck, A. Moeinvaziri, and J. C. Pechmann (2000). New real-time urban strong-motion network in Utah (Phase I) (abs.), *Eos, Trans. Am. Geophys. Union* **81** (48), F864.
- Arabasz, W. J., J. C. Pechmann, and M. K. McCarter (2001). Mechanisms and ground-truth observations for the largest ( $M_L = 3.0-4.2$ ) coal-mining-induced seismic events in Utah, 1978-2000 [abs.]: *Seismological Research Letters* **72** (2), 286.
- Ashland, F. X. (2001). Site-response characterization for implementing ShakeMap in northern Utah: *Utah Geological Survey Report of Investigations 248*, 10 pp. plus 2 plates [report completed by Utah Geological Survey, with funding from the Utah Division of Comprehensive Emergency Management, in partnership with the University of Utah Seismograph Stations.
- Black, B. D., W. R. Lund, and B. H. Mayes (1995). Summary of new information from the South Fork Dry Creek site, Salt Lake County, Utah, in *Environmental and Engineering Geology of the Wasatch Front Region*, W. R. Lund, editor, *Utah Geol. Assoc. Publ.* **24**, 11-30.
- Frankel, A., C. Mueller, T. Barnhard, D. Perkins, E. V. Leyendecker, N. Dickman, S. Hanson, and M. Hopper (1996). National Seismic Hazard Maps: Documentation June 1996, *U.S. Geol. Surv. Open-File Rept.* 96-532.

- FEMA (2000). *HAZUS 99 Estimated Annualized Earthquake Losses for the United States*, Federal Emergency Management Agency, *FEMA 366*, Washington, DC, 32 pp.
- Machette, M. N., S. F. Personius, A. R. Nelson, and D. P. Schwartz (1991). The Wasatch fault zone, Utah—segmentation and history of Holocene earthquakes, *J. Struct. Geol.* **13** (2), 137-149.
- McCalpin, J. P. and C. V. Nelson (2000). Long recurrence records from the Wasatch fault zone, Utah, Final Technical Report, Contract 99HQGR0058, National Earthquake Hazards Reduction Program, U.S. Geological Survey, 61 pp.
- McCalpin, J. P. and S. P. Nishenko (1996). Holocene paleoseismicity, temporal clustering, and probabilities of future large ( $M > 7$ ) earthquakes on the Wasatch fault zone, Utah, *J. Geophys. Res.* **101** (B3), 6233-6253.
- Pankow, K. L., J. C. Pechmann, S. J. Nava, and W. J. Arabasz (2001). Implementing ShakeMap in Utah before the 2000 Winter Olympics [abs.]: *Seismological Research Letters* **72** (2), 232.
- Pechmann, J. C., S. J. Nava, J. C. Bernier, and W. J. Arabasz (2000). A critical analysis of systematic time-dependent coda-magnitude errors in the University of Utah earthquake catalog, 1981-1999 (abs.), *Eos, Trans. Am. Geophys. Union* **81** (48), F869.
- Pechmann, J. C., J. C. Bernier, S. J. Nava, F. M. Terra, and W. J. Arabasz (2001). Correction of systematic time-dependent coda-magnitude errors in the Utah and Yellowstone National Park Region earthquake catalogs, 1981-2001 [abs.]: *Eos, Trans. Am. Geophys. Union* **82** (47), Fall Meet. Suppl., F809.
- Rojahn, C., S. A. King, R. E. Scholl, A. S. Kiremidjian, L. D. Reaveley, and R. R. Wilson (1997). Earthquake damage and loss estimation methodology and data for Salt Lake County, Utah (ATC-36), *Earthquake Spectra* **13** (4), 623-642.

## REPORTS AND PUBLICATIONS

- Arabasz, W. J., J. C. Pechmann, and M. K. McCarter (2001). Mechanisms and ground-truth observations for the largest ( $M_L = 3.0-4.2$ ) coal-mining-induced seismic events in Utah, 1978-2000 [abs.]: *Seismological Research Letters* **72** (2), 286.
- Arabasz, W. J. and IMW Working Group (2001). FY2002 ANSS Implementation Plan—Intermountain West (IMW) Region, (part of National Implementation Plan for an Advanced National Seismic System), <[www.seis.utah.edu/anss/toc.shtml](http://www.seis.utah.edu/anss/toc.shtml)>, 80 p.
- Ashland, F. X. (2001). Site-response characterization for implementing ShakeMap in northern Utah: *Utah Geological Survey Report of Investigation 248*, 10 pp plus 2 plates [report completed by Utah Geological Survey, with funding from the Utah Division of

Comprehensive Emergency Management, in partnership with the University of Utah Seismograph Stations].

Nava, S. J. (2001). Earthquake activity in the Utah region [summaries and maps of seismicity in the Utah region, published quarterly by the Utah Division of Comprehensive Emergency Management in *Fault Line Forum*].

Pankow, K. L., J. C. Pechmann, S. J. Nava, and W. J. Arabasz (2001). Implementing ShakeMap in Utah before the 2000 Winter Olympics [abs.]: *Seismological Research Letters* **72** (2), 232.

Pechmann, J. C., J. C. Bernier, S. J. Nava, F. M. Terra, and W. J. Arabasz (2001). Correction of systematic time-dependent coda-magnitude errors in the Utah and Yellowstone National Park Region earthquake catalogs, 1981-2001 [abs.]: *Eos, Trans. Am. Geophys. Union* **82** (47), Fall Meet. Suppl., F809.

APPENDIX A

Station Information for University of Utah Regional/Urban Seismic Network  
December 31, 2001

**Table A-1**  
**UNIVERSITY OF UTAH REGIONAL/URBAN SEISMIC NETWORK**  
**Operating Seismograph Stations**  
**December 31, 2001**

| UURSN Code | Location  | SEED Station | SEED Channel | No. of Channels | Network Code | Latitude   | Longitude   | Elevation (meters) | Sensor    | Digitizer | Telemetry | Sponsor |
|------------|---|--------------|--------------|-----------------|--------------|------------|-------------|--------------------|-----------|-----------|-----------|---------|
| AHI        | Auburn, ID  | AHID         | BH[ZEN]      | 3               | US           | 42° 45.92' | 111° 06.02' | 1960               | *         | *         | Digital   | USGS    |
| ALP        | Alpine Fire Station, Alpine, UT                   | ALP          | EN[ZEN]      | 3               | UU           | 40° 27.27' | 111° 46.67' | 1510               | EpiSensor | K2        | Digital   | ANSS    |
| AMF        | Tri-Cities Golf Course<br>American Fork, UT       | AMF          | EN[ZEN]      | 3               | UU           | 40° 24.12' | 111° 47.28' | 1445               | EpiSensor | K2        | Digital   | ANSS    |
| ARUT       | Antelope Range, UT                                | ARUT         | EHZ          | 1               | UU           | 37° 47.28' | 113° 26.42' | 1646               | L4C       | Masscomp  | Analog    | Utah    |
| BBU        | Bumble Bee, Salt Lake City, UT                    | BBU          | EH[ZEN]      | 3               | UU           | 40° 44.73' | 112° 00.67' | 1291               | L4C       | Masscomp  | Analog    | USGS    |
| BCS        | Brigham City Maintenance Shop<br>Brigham City, UT | BCS          | EN[ZEN]      | 3               | UU           | 40° 30.71' | 112° 01.98' | 1303               | EpiSensor | K2        | Digital   | ANSS    |
| BCU        | Brigham City, UT                                  | BCU          | EN[ZEN]      | 3               | UU           | 41° 30.74' | 111° 58.93' | 1676               | EpiSensor | K2        | Digital   | ANSS    |
| BEA        | Beaver Mountain, WY                               | BEAW         | EHZ          | 1               | RE           | 43° 15.06' | 110° 36.80' | 2960               | *         | *         | Analog    | USBR    |
| BEI        | Bear River Range, ID                              | BEI          | EHZ          | 1               | UU           | 42° 07.00' | 111° 46.94' | 1859               | L4C       | Masscomp  | Analog    | USGS    |
| BES        | Bates Elementary School<br>Ogden, UT              | BES          | EN[ZEN]      | 3               | UU           | 42° 19.10' | 111° 57.26' | 1455               | EpiSensor | K2        | Digital   | ANSS    |
| BGU        | Big Grassy Mountain, UT                           | BGU          | EN[ZEN]      | 3               | UU           | 37° 55.25' | 113° 01.79' | 1640               | Episensor | 72A-07    | Digital   | ANSS    |
|            |   |              | HH[ZEN]      | 3               |              |            |             |                    | 40T       |           |           |         |
| BHU        | Blowhard Mountain, UT                             | BHU          | EH[ZEN]      | 3               | UU           | 37° 35.55' | 112° 51.42' | 3230               | S13       | Masscomp  | Analog    | Utah    |
| BMUT       | Black Mountain, UT                                | BMUT         | EHZ          | 1               | UU           | 41° 57.49' | 111° 14.05' | 2243               | S13       | Masscomp  | Analog    | USGS    |
| BOZ        | Bozeman, MT                                       | BOZ          | BH[ZEN]      | 3               | US           | 45° 38.82' | 111° 37.78' | 1589               | *         | *         | Digital   | USGS    |
| BSS        | Butlerville Substation<br>Salt Lake City, UT      | BSS          | EN[ZEN]      | 3               | UU           | 40° 37.45' | 111° 49.34' | 1451               | EpiSensor | K2        | Digital   | ANSS    |
| BTU        | Barney Top, UT                                    | BTU          | EHZ          | 1               | UU           | 37° 45.34' | 111° 52.46' | 3235               | S13       | Masscomp  | Analog    | Utah    |
| BYU        | Brigham Young University<br>Provo, UT             | BYU          | EN[ZEN]      | 3               | UU           | 40° 15.19' | 111° 38.95' | 1421               | EpiSensor | K2        | Digital   | ANSS    |
| BW0        | Boulder, WY                                       | BW06         | BH[ZEN]      | 3               | US           | 42° 46.00' | 109° 33.49' | 2224               | *         | *         | Digital   | USGS    |
| CFS        | Copperton Fire Station<br>Copperton, UT           | CFS          | EN[ZEN]      | 3               | UU           | 40° 33.94' | 112° 05.61' | 1654               | EpiSensor | K2        | Digital   | ANSS    |
| COM        | Craters of the Moon, ID                           | COMI         | EHZ          | 1               | IE           | 43° 27.72' | 113° 35.64' | 1890               | *         | *         | Analog    | INEEL   |
| CTU        | Camp Tracy, UT                                    | CTU          | HH[ZEN]      | 3               | UU           | 40° 41.55' | 111° 45.02' | 1731               | 40T       | 72A-07    | Digital   | USGS    |
| CWU        | Camp Williams, UT                                 | CWU          | EHZ          | 1               | UU           | 40° 26.75' | 112° 06.13' | 1945               | L4C       | Masscomp  | Analog    | USGS    |

| UURSN Code | Location                            | SEED Station | SEED Channel       | No. of Channels | Network Code | Latitude   | Longitude   | Elevation (meters) | Sensor    | Digitizer | Telemetry | Sponsor    |
|------------|-------------------------------------|--------------|--------------------|-----------------|--------------|------------|-------------|--------------------|-----------|-----------|-----------|------------|
| DAU        | Daniels Canyon, UT                  | DAU          | EHZ                | 1               | UU           | 40° 24.75' | 111° 15.35' | 2771               | S13       | Masscomp  | Analog    | Utah       |
| DBD        | Des Bee Dove, UT                    | DBD          | EHZ                | 1               | UU           | 39° 18.82' | 111° 05.55' | 2265               | L4C       | Masscomp  | Analog    | Utah       |
| DCU        | Deer Creek Reservoir, UT            | DCU          | EHZ                | 1               | UU           | 40° 24.82' | 111° 31.61' | 1829               | L4C       | Masscomp  | Analog    | Utah       |
| DUG        | Dugway, UT                          | DUG          | BH[ZEN]            | 3               | US           | 40° 11.70' | 112° 48.80' | 1477               | *         | *         | Digital   | USGS       |
|            |                                     |              | EH[ZEN]<br>EL[ZEN] | 6               | UU           |            |             |                    | S13       | Masscomp  | Analog    | Utah, USGS |
| DWU        | Dry Willow, UT                      | DWU          | EHZ                | 1               | UU           | 38° 06.32' | 112° 59.85' | 2270               | S13       | Masscomp  | Analog    | Utah       |
| ECR        | Eagle Creek, ID                     | ECRI         | EHZ                | 1               | IE           | 43° 03.24' | 111° 22.26' | 2086               | *         | *         | Analog    | INEEL      |
| EKU        | East Kanab, UT                      | EKU          | EHZ                | 1               | UU           | 37° 04.48' | 112° 29.81' | 1829               | 18300     | Masscomp  | Analog    | Utah       |
| ELK        | Elko, NV                            | ELK          | BH[ZEN]            | 3               | US           | 40° 44.69' | 115° 14.33' | 2210               | *         | *         | Digital   | USGS       |
| ELU        | Electric Lake, UT                   | ELU          | EHZ                | 1               | UU           | 39° 38.41' | 111° 12.23' | 2976               | L4C       | Masscomp  | Analog    | Utah       |
| EMU        | Emma Park, UT                       | EMU          | EH[ZEN]<br>ELZ     | 4               | UU           | 39° 48.84' | 110° 48.92' | 2268               | S13       | Masscomp  | Analog    | USGS       |
| EPU        | East Promontory, UT                 | EPU          | EHZ                | 1               | UU           | 41° 23.49' | 112° 24.53' | 1436               | L4C       | Masscomp  | Analog    | USGS       |
| FLU        | Fool's Peak, UT                     | FLU          | EHZ                | 1               | UU           | 39° 22.69' | 112° 10.29' | 1951               | 18300     | Masscomp  | Analog    | USGS       |
| FPU        | Francis Peak, UT                    | FPU          | EHZ                | 1               | UU           | 41° 01.58' | 111° 50.21' | 2816               | L4C       | Masscomp  | Analog    | USGS       |
| FSU        | Fish Springs, UT                    | FSU          | EHZ                | 1               | UU           | 39° 43.35' | 113° 23.48' | 1487               | 18300     | Masscomp  | Analog    | Utah       |
| GBI        | Big Grassy Butte, ID                | GBI          | EHZ                | 1               | IE           | 43° 59.22' | 112° 03.78' | 1541               | *         | *         | Analog    | INEEL      |
| GMU        | Granite Mountain, UT                | GMU          | EH[ZEN]<br>ELZ     | 4               | UU           | 40° 34.53' | 111° 45.79' | 1829               | S13       | Masscomp  | Analog    | USGS       |
| GMV        | Granite Mountain Vault Sandy, UT    | GMV          | EN[ZEN]            | 3               | UU           | 40° 34.40' | 111° 45.79' | 1768               | EpiSensor | K2        | Digital   | ANSS       |
| GRD        | Gardner Farm, UT                    | GRD          | EHZ                | 1               | UU           | 40° 35.90' | 111° 55.55' | 1323               | Ranger    | Masscomp  | Analog    | USGS       |
| GRR        | Grays Lake, ID                      | GRR1         | EHZ                | 1               | IE           | 42° 56.28' | 111° 25.32' | 2207               | *         | *         | Analog    | INEEL      |
| GZU        | Grizzly Peak, UT                    | GZU          | EH[ZEN]<br>ELZ     | 4               | UU           | 41° 25.53' | 111° 58.50' | 2646               | S13       | Masscomp  | Analog    | USGS       |
| HCO        | Holladay City Offices Holladay, UT  | HCO          | EN[ZEN]            | 3               | UU           | 41° 40.08' | 111° 49.39' | 1362               | EpiSensor | K2        | Digital   | ANSS       |
| HDU        | Hyde Park, UT                       | HDU          | EHZ                | 1               | UU           | 41° 48.27' | 111° 45.89' | 1853               | L4C       | Masscomp  | Analog    | USGS       |
| HER        | Herriman Fire Station Herriman, UT  | HER          | EN[ZEN]            | 3               | UU           | 40° 30.94' | 112° 01.85' | 1502               | EpiSensor | K2        | Digital   | ANSS       |
| HES        | Hooper Elementary School Hooper, UT | HES          | EN[ZEN]            | 3               | UU           | 41° 09.89' | 112° 07.30' | 1292               | EpiSensor | K2        | Digital   | ANSS       |
| HHA        | Hell's Half Acre, ID                | HHAI         | EHZ                | 1               | IE           | 43° 17.70' | 112° 22.74' | 1371               | *         | *         | Analog    | INEEL      |
| HLI        | Hailey, ID                          | HLID         | BH[ZEN]            | 3               | US           | 43° 33.75' | 114° 24.83' | 1772               | *         | *         | Digital   | USGS       |

| UURSN Code | Location  | SEED Station | SEED Channel | No. of Channels | Network Code | Latitude   | Longitude   | Elevation (meters) | Sensor    | Digitizer | Telemetry | Sponsor |
|------------|---|--------------|--------------|-----------------|--------------|------------|-------------|--------------------|-----------|-----------|-----------|---------|
| HLJ        | Hailstone, UT   | HLJ          | EH[ZEN]      | 3               | UU           | 40° 36.63' | 111° 24.04' | 1931               | S13       | Masscomp  | Analog    | Utah    |
| HONU       | Honeyville, UT  | HONU         | EHZ          | 1               | UU           | 41° 36.90' | 112° 03.00' | 1515               | L4C       | Masscomp  | Analog    | USGS    |
| HRU        | Hogsback Ridge, UT                                      | HRU          | EHZ          | 1               | UU           | 40° 47.17' | 111° 53.09' | 1640               | Ranger    | Masscomp  | Analog    | USGS    |
| HTU        | Hoyt, UT  | HTU          | EHZ          | 1               | UU           | 40° 40.52' | 111° 13.21' | 2576               | L4C       | Masscomp  | Analog    | USGS    |
| HVU        | Hansel Valley, UT                                       | HVU          | HH[ZEN]      | 3               | UU           | 41° 46.78' | 112° 46.50' | 1609               | 40T       | 72A-07    | Digital   | USGS    |
| HWU        | Hardware Ranch, UT                                      | HWUT         | BH[ZEN]      | 3               | US           | 41° 36.41' | 111° 33.91' | 1830               | *         | *         | Digital   | USGS    |
| ICF        | International Center Fire Station<br>Salt Lake City, UT | ICF          | EN[ZEN]      | 3               | UU           | 40° 46.68' | 112° 01.69' | 1281               | EpiSensor | K2        | Digital   | ANSS    |
| ICU        | Indian Springs Canyon, UT                               | ICU          | EHZ          | 1               | UU           | 37° 08.98' | 113° 55.41' | 1451               | S13       | Masscomp  | Analog    | Utah    |
| IMU        | Iron Mountain, UT                                       | IMU          | EHZ          | 1               | UU           | 38° 37.99' | 113° 09.50' | 1833               | L4C       | Masscomp  | Analog    | Utah    |
| IMW        | Indian Meadows, WY                                      | IMW          | EHZ          | 1               | RC           | 43° 53.82' | 110° 56.34' | 2646               | *         | *         | Analog    | BYU-I   |
| JLU        | Jordanelle, UT  | JLU          | EN[ZEN]      | 3               | UU           | 40° 36.12' | 111° 27.00' | 2285               | EpiSensor | 72A-07    | Digital   | ANSS    |
|            |   |              | HH[ZEN]      | 3               |              |            |             |                    | 3ESP      |           |           |         |
| JRP        | Jordan River State Park<br>Salt Lake City, UT           | JRP          | EN[ZEN]      | 3               | UU           | 40° 49.54' | 111° 56.66' | 1284               | EpiSensor | K2        | Digital   | ANSS    |
| KLJ        | Keetley, UT   | KLJ          | EHZ          | 1               | UU           | 40° 37.85' | 111° 24.30' | 1992               | S13       | Masscomp  | Analog    | Utah    |
| KNB        | Kanab, UT   | KNB          | BH[ZEN]      | 3               | US           | 37° 01.00' | 112° 49.34' | 1715               | *         | *         | Digital   | LLNL    |
| LDJ        | Lady, UT  | LDJ          | EHZ          | 1               | UU           | 40° 34.89' | 111° 24.52' | 2217               | S13       | Masscomp  | Analog    | Utah    |
| LEVU       | Levan, UT   | LEVU         | EHZ          | 1               | UU           | 39° 30.39' | 111° 48.88' | 1996               | L4C       | Masscomp  | Analog    | USGS    |
| LGC        | Lakeside Golf Course<br>Bountiful, UT                   | LGC          | EN[ZEN]      | 3               | UU           | 40° 54.04' | 111° 54.51' | 1292               | EpiSensor | K2        | Digital   | ANSS    |
| LKC        | Lee Kay Hunter Education Center<br>Magna, UT            | LKC          | EN[ZEN]      | 3               | UU           | 40° 43.72' | 112° 02.15' | 1292               | EpiSensor | K2        | Digital   | ANSS    |
| LKW        | Lake, WY  | LKWY         | BH[ZEN]      | 3               | US           | 44° 33.91' | 110° 24.00' | 2424               | *         | *         | Digital   | USGS    |
| LMU        | Lake Mountain, UT                                       | LMU          | EN[ZEN]      | 3               | UU           | 40° 18.91' | 111° 55.92' | 1593               | EpiSensor | K2        | Digital   | ANSS    |
| LOH        | Long Hollow, WY   | LOHW         | EHZ          | 1               | RE           | 43° 36.75' | 110° 36.23' | 2121               | *         | *         | Analog    | USBR    |
| LSU        | Lake Shores, UT   | LSU          | EN[ZEN]      | 3               | UU           | 40° 07.94' | 111° 43.81' | 1375               | EpiSensor | K2        | Digital   | ANSS    |
| LTU        | Little Mountain, UT                                     | LTU          | EHZ          | 1               | UU           | 41° 35.51' | 112° 14.83' | 1585               | L4C       | Masscomp  | Analog    | USGS    |
| MAB        | Mapleton Ambulance Building<br>Mapleton, UT             | MAB          | EN[ZEN]      | 3               | UU           | 41° 07.79' | 111° 34.67' | 1440               | EpiSensor | K2        | Digital   | ANSS    |
| MCID       | Moose Creek, ID   | MCID         | EHZ          | 1               | WY           | 44° 11.42' | 111° 10.96' | 2149               | L4C       | Masscomp  | Analog    | USGS    |
| MCU        | Monte Cristo Peak, UT                                   | MCU          | EHZ          | 1               | UU           | 41° 27.70' | 111° 30.45' | 2664               | 18300     | Masscomp  | Analog    | USGS    |
| MGU        | Meadow Brook Golf Course<br>Salt Lake City, UT          | MGU          | EHZ          | 1               | UU           | 40° 40.89' | 111° 55.09' | 1291               | Ranger    | Masscomp  | Analog    | USGS    |
| MHD        | Mile High Drive, UT                                     | MHD          | EHZ          | 1               | UU           | 40° 39.64' | 111° 48.05' | 1597               | Ranger    | Masscomp  | Analog    | USGS    |

| UURSN Code | Location                                     | SEED Station | SEED Channel   | No. of Channels | Network Code | Latitude   | Longitude   | Elevation (meters) | Sensor    | Digitizer | Telemetry | Sponsor |
|------------|--|--------------|----------------|-----------------|--------------|------------|-------------|--------------------|-----------|-----------|-----------|---------|
| MLI        | Malad Range, ID                              | MLI          | EHZ            | 1               | UU           | 42° 01.61' | 112° 07.53' | 1896               | L4C       | Masscomp  | Analog    | USGS    |
| MMU        | Miners Mountain, UT                          | MMU          | EHZ            | 1               | UU           | 38° 11.91' | 111° 17.66' | 2387               | S13       | Masscomp  | Analog    | Utah    |
| MOUT       | Mount Ogden, UT                              | MOUT         | EHZ            | 1               | UU           | 41° 11.94' | 111° 52.73' | 2743               | S13       | Masscomp  | Analog    | USGS    |
| MPU        | Maple Canyon, UT                             | MPU          | EN[ZEN]        | 3               | UU           | 40° 00.93' | 111° 38.00' | 1909               | EpiSensor | K2        | Digital   | ANSS    |
|            |  |              | HH[ZEN]        | 3               |              |            |             |                    | 40T       | 72A-07    | Digital   | USGS    |
| MSU        | Marysvale, UT                                | MSU          | EHZ            | 1               | UU           | 38°30.74'  | 112° 10.63' | 2105               | 18300     | Masscomp  | Analog    | Utah    |
| MTUT       | Morton Thiokol, UT                           | MTUT         | EHZ            | 1               | UU           | 41° 42.55  | 112° 27.28' | 1373               | L4C       | Masscomp  | Analog    | USGS    |
| MVU        | Marysvale, UT                                | MVU          | BH[ZEN]        | 3               | LB           | 38° 30.22' | 112° 12.74' | 2240               | *         | *         | Digital   | Sandia  |
| NAI        | North Antelope Island, UT                    | NAI          | EN[ZEN]        | 3               | UU           | 41° 00.97' | 112° 13.68' | 1472               | EpiSensor | K2        | Digital   | ANSS    |
| NAIU       |  | NAIU         | EHZ            | 1               |              |            |             |                    | L4C       | Masscomp  | Analog    | USGS    |
| NLU        | North Lily Mine, UT                          | NLU          | EN[ZEN]        | 3               | UU           | 39° 57.29' | 112° 04.50' | 2036               | 3ESP      | 72A-07    | Digital   | ANSS    |
|            |  |              | HH[ZEN]        | 3               |              |            |             |                    | EpiSensor |           |           |         |
| NMU        | North Mineral Mountain, UT                   | NMU          | EH[ZEN]<br>ELZ | 4               | UU           | 38° 30.99' | 112° 51.00' | 1853               | S13       | Masscomp  | Analog    | Utah    |
| NOQ        | North Oquirrh Mountains, UT                  | NOQ          | EN[ZEN]        | 3               | UU           | 40° 39.15' | 112° 07.22' | 1622               | EpiSensor | K2        | Digital   | ANSS    |
|            |  |              | HH[ZEN]        | 3               |              |            |             |                    | 40T       | 72A-07    | Digital   | USGS    |
| NPI        | North Pocatello, ID                          | NPI          | EHZ            | 1               | UU           | 42° 08.84' | 112° 31.10' | 1640               | L4C       | Masscomp  | Analog    | USGS    |
| OCF        | Orem City Park, Orem, UT                     | OCF          | EN[ZEN]        | 3               | UU           | 40° 17.88' | 111° 41.44' | 1464               | EpiSensor | K2        | Digital   | ANSS    |
| OF2        | Ogden Fire Station #2<br>Ogden, UT           | OF2          | EN[ZEN]        | 3               | UU           | 41° 13.70' | 111° 56.92' | 1358               | EpiSensor | K2        | Digital   | ANSS    |
| OWUT       | Old Woman Plateau, UT                        | OWUT         | EHZ            | 1               | UU           | 38° 46.80' | 111° 25.42' | 2568               | L4C       | Masscomp  | Analog    | Utah    |
| PCR        | Park City Recreation Center<br>Park City, UT | PCR          | EN[ZEN]        | 3               | UU           | 40° 39.26' | 111° 30.20' | 2100               | EpiSensor | K2        | Digital   | ANSS    |
| PGC        | Pleasant Grove Creek, UT                     | PGC          | EN[ZEN]        | 3               | UU           | 40° 22.72' | 111° 42.61' | 1707               | EpiSensor | K2        | Digital   | ANSS    |
| PTI        | Pocatello Valley, ID                         | PTI          | EHZ            | 1               | UU           | 42° 52.22' | 112° 22.21' | 1670               | L4C       | Masscomp  | Analog    | USGS    |
| PTU        | Portage, UT                                  | PTU          | EHZ            | 1               | UU           | 41° 55.76' | 112° 19.48' | 2192               | L4C       | Masscomp  | Analog    | USGS    |
| P03        | Wild Steer, Paradox Basin, CO                | PV03         | EHZ            | 1               | RE           | 38° 15.26' | 108° 50.88' | 1975               | *         | *         | Analog    | USBR    |
| P15        | Potato Mountain<br>Paradox Basin, CO         | PV15         | EHZ            | 1               | RE           | 38° 20.51' | 108° 28.86' | 2280               | *         | *         | Analog    | USBR    |
| RBU        | Red Butte Canyon, UT                         | RBU          | EHZ            | 1               | UU           | 40° 46.85' | 111° 48.50' | 1676               | L4C       | Masscomp  | Analog    | USGS    |
| RCJ        | Ross Creek, UT                               | RCJ          | EH[ZEN]        | 3               | UU           | 40° 39.51' | 111° 26.36' | 2090               | S13       | Masscomp  | Analog    | Utah    |
| RIV        | Public Works Building<br>Riverton, UT        | RIV          | EN[ZEN]        | 3               | UU           | 40° 31.15' | 111° 56.06' | 1347               | EpiSensor | K2        | Digital   | ANSS    |
| RSUT       | Red Spur, UT                                 | RSUT         | EHZ            | 1               | UU           | 41° 38.31' | 111° 25.90' | 2682               | S13       | Masscomp  | Analog    | USGS    |

| UURSN Code | Location  | SEED Station | SEED Channel | No. of Channels | Network Code | Latitude   | Longitude   | Elevation (meters) | Sensor    | Digitizer | Telemetry | Sponsor |
|------------|---|--------------|--------------|-----------------|--------------|------------|-------------|--------------------|-----------|-----------|-----------|---------|
| SAIU       | South Antelope Island, UT                       | SAIU         | EHZ          | 1               | UU           | 40° 51.29' | 112° 10.89' | 1384               | L4C       | Masscomp  | Analog    | USGS    |
| SCC        | Salt Lake Community College Salt Lake City, UT  | SCC          | EN[ZEN]      | 3               | UU           | 40° 40.49' | 111° 56.37' | 1306               | EpiSensor | K2        | Digital   | ANSS    |
| SCS        | Syracuse City Cemetery Shop Syracuse, UT        | SCS          | EN[ZEN]      | 3               | UU           | 41° 05.73' | 112° 02.81' | 1321               | EpiSensor | K2        | Digital   | ANSS    |
| SGU        | Sterling, UT                                    | SGU          | EHZ          | 1               | UU           | 39° 10.94' | 111° 38.68' | 2357               | L4C       | Masscomp  | Analog    | USGS    |
| SLC        | University of Utah WBB Bldg. Salt Lake City, UT | SLC          | EL[EN]       | 2               | UU           | 40° 45.97' | 111° 50.86' | 1436               | WA Sim    | Masscomp  | Hardwired | USGS    |
|            |   |              | EN[ZEN]      | 3               |              |            |             |                    | FBA23     | Masscomp  |           |         |
| SNO        | Snow College, UT                                | SNO          | EHZ          | 1               | UU           | 39° 19.18' | 111° 32.33' | 2503               | Ranger    | Masscomp  | Analog    | Utah    |
| SNUT       | Stanbury North, UT                              | SNUT         | EHZ          | 1               | UU           | 40° 53.14' | 112° 30.54' | 1652               | 18300     | Masscomp  | Analog    | USGS    |
| SPR        | Wildlife Resource Center Springville, UT        | SPR          | EN[ZEN]      | 3               | UU           | 40° 10.99' | 111° 36.68' | 1379               | EpiSensor | K2        | Digital   | ANSS    |
| SPU        | South Promontory Point, UT                      | SPU          | EN[ZEN]      | 3               | UU           | 41° 18.52' | 112° 26.95' | 2086               | EpiSensor | 72A-07    | Digital   | ANSS    |
|            |   |              | HH[ZEN]      | 3               |              |            |             |                    | 3ESP      |           |           |         |
| SRU        | San Rafael Swell, UT                            | SRU          | EHZ          | 1               | UU           | 39° 06.65' | 110° 31.43' | 1804               | 18300     | Masscomp  | Analog    | Utah    |
|            |   |              | HH[ZEN]      | 3               |              |            |             |                    | 3T        | 72A-07    | Digital   |         |
| SSC        | Sandy Senior Center Sandy, UT                   | SSC          | EN[ZEN]      | 3               | UU           | 40° 34.89' | 111° 51.35' | 1414               | EpiSensor | K2        | Digital   | ANSS    |
| SUU        | Santaquin Canyon, UT                            | SUU          | EHZ          | 1               | UU           | 39° 53.29' | 111° 47.45' | 2024               | 18300     | Masscomp  | Analog    | USGS    |
| TB1        | Trail Mountain Base #1, UT                      | TB1          | EHZ          | 4               | UU           | 39° 18.20' | 111° 16.23' | 2188               | L4C       | K2        | None      | Utah    |
|            |   |              | EN[ZEN]      |                 |              |            |             |                    | EpiSensor |           |           |         |
| TB2        | Trail Mountain Base #2, UT                      | TB2          | EHZ          | 4               | UU           | 39° 17.29' | 111° 14.45' | 2082               | L4C       | K2        | None      | Utah    |
|            |   |              | EN[ZEN]      |                 |              |            |             |                    | EpiSensor |           |           |         |
| TCU        | Toone Canyon, UT                                | TCU          | EN[ZEN]      | 3               | UU           | 41° 07.04' | 111° 24.47' | 2269               | EpiSensor | 72A-07    | Digital   | ANSS    |
|            |   |              | HH[ZEN]      | 3               |              |            |             |                    | 3ESP      |           |           |         |
| TCUT       |   | TCUT         | EHZ          | 1               | UU           | 41° 07.07' | 111° 24.51' | 2320               | L4C       | Masscomp  | Analog    | USGS    |
| TMI        | Taylor Mountain, ID                             | TMI          | EHZ          | 1               | IE           | 43° 18.30' | 111° 55.08' | 2179               | *         | *         | Analog    | INEEL   |
| TMU        | Trail Mountain, UT                              | TMU          | EN[ZEN]      | 3               | UU           | 39° 17.79' | 111° 12.49' | 2731               | EpiSensor | 72A-07    | Digital   | Utah    |
| TM2        |   | TM2          | EH[ZEN]      | 3               |              |            |             |                    | S13       |           |           |         |
| TPNV       | Topopah Spring, NV                              | TPNV         | BH[ZEN]      | 3               | US           | 36° 56.93' | 116° 14.97' | 1600               | *         | *         | Digital   | USGS    |
| TPU        | Thanksgiving Point, Lehi, UT                    | TPU          | EN[ZEN]      | 3               | UU           | 40° 25.81' | 111° 54.13' | 1383               | EpiSensor | K2        | Digital   | ANSS    |
| TRS        | Tooele County Communications Shop, Tooele, UT   | TRS          | EN[ZEN]      | 3               | UU           | 40° 30.83' | 112° 18.63' | 1568               | EpiSensor | K2        | Digital   | ANSS    |
| UHP        | Utah Highway Patrol Farmington,                 | UHP          | EN[ZEN]      | 3               | UU           | 40° 59.50' | 111° 53.85' | 1295               | EpiSensor | K2        | Digital   | ANSS    |

| UURSN Code | Location   | SEED Station | SEED Channel   | No. of Channels | Network Code | Latitude   | Longitude   | Elevation (meters) | Sensor    | Digitizer | Telemetry | Sponsor |
|------------|--|--------------|----------------|-----------------|--------------|------------|-------------|--------------------|-----------|-----------|-----------|---------|
|            | UT   |              |                |                 |              |            |             |                    |           |           |           |         |
| UTH        | Uintah Town Hall, Uintah, UT                     | UTH          | EN[ZEN]        | 3               | UU           | 41° 08.65' | 111° 55.52' | 1389               | EpiSensor | K2        | Digital   | ANSS    |
| UUE        | University of Utah EMCB Bldg. Salt Lake City, UT | UUE          | EN[ZEN]        | 3               | UU           | 40° 46.11' | 111° 50.72' | 1449               | EpiSensor | K2        | Digital   | ANSS    |
| WBC        | Weber Canyon, UT                                 | WBC          | EN[ZEN]        | 3               | UU           | 41° 08.38' | 111° 54.05' | 1602               | EpiSensor | K2        | Digital   | ANSS    |
| WCU        | Willow Creek, UT                                 | WCU          | EHZ            | 1               | UU           | 38° 57.88' | 112° 05.44' | 2673               | 18300     | Masscomp  | Analog    | USGS    |
| WES        | Westminister College Salt Lake City, UT          | WES          | EN[ZEN]        | 3               | UU           | 40° 43.97' | 111° 51.26' | 1341               | EpiSensor | K2        | Digital   | ANSS    |
| WHS        | West High School Salt Lake City, UT              | WHS          | EN[ZEN]        | 3               | UU           | 40° 46.51' | 111° 53.93' | 1301               | EpiSensor | K2        | Digital   | ANSS    |
| WLJ        | Wildlife, UT                                     | WLJ          | EHZ            | 1               | UU           | 40° 36.80' | 111° 20.68' | 2075               | S13       | Masscomp  | Analog    | Utah    |
| WMUT       | West Mountain, UT                                | WMUT         | EHZ            | 1               | UU           | 40° 04.60' | 111° 50.00' | 1981               | L4C       | Masscomp  | Analog    | USGS    |
| WRG        | West Ridge Golf Course Magna, UT                 | WRG          | EN[ZEN]        | 3               | UU           | 40° 39.47' | 112° 01.93' | 1455               | EpiSensor | K2        | None      | ANSS    |
| WTU        | Western Traverse Mountains, UT                   | WTU          | EH[ZEN]<br>ELZ | 4               | UU           | 40° 27.29' | 111° 57.18' | 1579               | S13       | Masscomp  | Analog    | USGS    |
| WUAZ       | Wupatki, AZ                                      | WUAZ         | BH[ZEN]        | 3               | US           | 35° 31.01' | 111° 22.43' | 1592               | *         | *         | Digital   | USGS    |
| WVUT       | Wellsville, UT                                   | WVUT         | EHZ            | 1               | UU           | 41° 36.61' | 111° 57.55' | 1828               | L4C       | Masscomp  | Analog    | USGS    |
| YCJ        | Canyon Junction (YNP), WY                        | YCJ          | EHZ            | 1               | WY           | 44° 44.63' | 110° 29.85' | 2426               | L4C       | Masscomp  | Analog    | USGS    |
| YDC        | Denny Creek, MT                                  | YDC          | EHZ            | 1               | WY           | 44° 42.57' | 111° 14.38' | 2025               | L4C       | Masscomp  | Analog    | USGS    |
| YFT        | Old Faithful (YNP), WY                           | YFT          | EHZ            | 1               | WY           | 44° 27.08' | 110° 50.15' | 2292               | L4C       | Masscomp  | Analog    | USGS    |
|            |  |              | HH[ZEN]        | 3               |              |            |             |                    | 40T       | 72A-07    | Digital   |         |
| YGC        | Grayling Creek, MT                               | YGC          | EHZ            | 1               | WY           | 44° 47.77' | 111° 06.39' | 2075               | L4C       | Masscomp  | Analog    | USGS    |
| YHB        | Horse Butte, MT                                  | YHB          | EHZ            | 1               | WY           | 44° 45.07' | 111° 11.71' | 2157               | L4C       | Masscomp  | Analog    | USGS    |
| YHH        | Holmes Hill (YNP), WY                            | YHH          | EH[ZEN]        | 3               | WY           | 44° 47.30' | 110° 51.03' | 2717               | S13       | Masscomp  | Analog    | USGS    |
| YJC        | Joseph's Coat (YNP), WY                          | YJC          | EH[ZEN]        | 3               | WY           | 44° 45.33' | 110° 20.95' | 2684               | S13       | Masscomp  | Analog    | USGS    |
| YLA        | Lake Butte (YNP), WY                             | YLA          | EHZ            | 1               | WY           | 44° 30.76' | 110° 16.12' | 2580               | L4C       | Masscomp  | Analog    | USGS    |
| YLT        | Little Thumb Creek (YNP), WY                     | YLT          | EHZ            | 1               | WY           | 44° 26.22' | 110° 35.24' | 2390               | L4C       | Masscomp  | Analog    | USGS    |
| YMC        | Maple Creek (YNP), WY                            | YMC          | EHZ            | 1               | WY           | 44° 45.56' | 111° 00.37' | 2073               | L4C       | Masscomp  | Analog    | USGS    |
| YML        | Mary Lake (YNP), WY                              | YML          | EHZ            | 1               | WY           | 44° 36.32' | 110° 38.59' | 2653               | L4C       | Masscomp  | Analog    | USGS    |
| YMR        | Madison River (YNP), WY                          | YMR          | HH[ZEN]        | 3               | WY           | 44° 40.12' | 110° 57.90' | 2149               | 40T       | 72A-07    | Digital   | USGS    |
| YMS        | Mount Sheridan (YNP), WY                         | YMS          | EHZ            | 1               | WY           | 44° 15.84' | 110° 31.67' | 3106               | L4C       | Masscomp  | Analog    | USGS    |
| YMV        | Mammoth Vault (YNP), WY                          | YMV          | EHZ            | 1               | WY           | 44° 58.42' | 110° 41.33' | 1829               | L4C       | Masscomp  | Analog    | USGS    |
| YNR        | Norris Junction (YNP), WY                        | YNR          | EH[ZEN]        | 3               | WY           | 44° 42.93' | 110° 40.75' | 2336               | 40T       | Masscomp  | Analog    | USGS    |
| YPC        | Pelican Cone (YNP), WY                           | YPC          | EHZ            | 1               | WY           | 44° 38.88' | 110° 11.55' | 2932               | L4C       | Masscomp  | Analog    | USGS    |

| <b>UURSN Code</b> | <b>Location</b>              | <b>SEED Station</b> | <b>SEED Channel</b> | <b>No. of Channels</b> | <b>Network Code</b> | <b>Latitude</b> | <b>Longitude</b> | <b>Elevation (meters)</b> | <b>Sensor</b> | <b>Digitizer</b> | <b>Telemetry</b> | <b>Sponsor</b> |
|-------------------|------------------------------|---------------------|---------------------|------------------------|---------------------|-----------------|------------------|---------------------------|---------------|------------------|------------------|----------------|
| YPM               | Purple Mountain (YNP), WY    | YPM                 | EHZ                 | 1                      | WY                  | 44° 39.43'      | 110° 52.12'      | 2582                      | L4C           | Masscomp         | Analog           | USGS           |
| YPP               | Pitchstone Plateau (YNP), WY | YPP                 | EHZ                 | 1                      | WY                  | 44° 16.26'      | 110° 48.27'      | 2707                      | S13           | Masscomp         | Analog           | USGS           |
| YSB               | Soda Butte (YNP), WY         | YSB                 | EHZ                 | 1                      | WY                  | 44° 53.04'      | 110° 09.06'      | 2072                      | L4C           | Masscomp         | Analog           | USGS           |
| YTP               | The Promontory (YNP), WY     | YTP                 | EHZ                 | 1                      | WY                  | 44° 23.51'      | 110° 17.10'      | 2384                      | L4            | Masscomp         | Analog           | USGS           |
| YWB               | West Boundary (YNP), WY      | YWB                 | EHZ                 | 1                      | WY                  | 44° 36.35'      | 111° 06.05'      | 2310                      | L4C           | Masscomp         | Analog           | USGS           |

\* Indicates station operated by another agency and recorded as part of University of Utah regional seismic network

Network Statistics: 354 data channels from 156 stations were being recorded at the end of this report period.

**EXPLANATION OF TABLE**

**UURSN Code:** Station code used in routine processing. Due to processing software limitations, the station code may not be the station code used by the original operator.

For multicomponent stations, the vertical, east-west, and north-south high gain (low gain) components are identified by an appended Z(V), E(L), and N(M), respectively.

**Location:** General description of station location. YNP = Yellowstone National Park.

**SEED Station:** The SEED (Standard for the Exchange of Earthquake Data) station code used by the original operator.

SEED Channel: The SEED format uses three letters to name seismic channels. See <<[http://www.iris.washington.edu/manuals/SEED\\_appA.html](http://www.iris.washington.edu/manuals/SEED_appA.html)>> for information about the SEED channel naming convention. Relevant sections are reproduced below. In the SEED convention, each letter describes one aspect of the instrumentation and its digitization. The first letter specifies the general sampling rate and the response band of the instrument. Band codes used in this table include:

| Band Code | Band Type              | Sample Rate        | Corner Period |
|-----------|------------------------|--------------------|---------------|
| E         | Extremely short period | ≥ 80 Hertz         | < 10 seconds  |
| H         | High broadband         | ≥ 80 Hertz         | ≥ 10 seconds  |
| B         | Broadband              | ≥ 10 to < 80 Hertz | ≥10 seconds   |

The second letter specifies the family to which the sensor belongs. Sensor families used in this table are:

| Instrument Code | Description           |
|-----------------|-----------------------|
| H               | High gain seismometer |
| L               | Low gain seismometer  |
| N               | Accelerometer         |

The third letter specifies the physical configuration of the members of a multiple axis instrument package. Channel orientations used in this table are:

Z E N      Traditional (Vertical, East-West, North-South)

**Number of Channels:** Total number of waveform channels recorded.

**Network Code:** The FDSN (Federation of Digital Seismographic Networks) registered network code. See <<<http://www.iris.washington.edu/FDSN/networks.txt>>> for information about registered seismograph network codes. Network codes referenced in this table:

| Network Code | Network name; Network operator or responsible organization                                 |
|--------------|--|
| LB           | Leo Brady Network; Sandia National Laboratory  |
| IE           | Idaho National Engineering and Environmental Laboratory                                    |
| RC           | Formerly Ricks College Network; Ricks College, Idaho; now BYU-Idaho                        |
| RE           | US Bureau of Reclamation Seismic Networks; US Bureau of Reclamation, Denver Federal Center |

|    |  |
|----|--|
| UU | University of Utah Regional Network; University of Utah          |
| US | US National Network; USGS National Earthquake Information Center |
| WY | Yellowstone Wyoming Seismic Network; University of Utah          |

**Latitude, Longitude:** Sensor location in degrees and decimal minutes; North latitude, West longitude.

**Elevation:** Sensor altitude in meters above sea level.

| <b>Sensor</b> | <b>Description</b>  |
|---------------|---|
| L4, L4C       | Mark Products short-period seismometer                            |
| S13, 18300    | Geotech S13 or 18300 short-period seismometer                     |
| Ranger        | Kinometrics Ranger short-period seismometer                       |
| 40T           | Guralp CMG-40T broadband seismometer                              |
| 3T            | Guralp CMG-3T broadband seismometer                               |
| 3ESP          | Guralp CMG-3ESP broadband seismometer                             |
| FBA23         | Kinometrics accelerometer   |
| EpiSensor     | Kinometrics accelerometer   |
| WA Sim        | Wood-Anderson displacement seismometer (electronically simulated) |

| <b>Digitizer</b> | <b>Description</b>   |
|------------------|--|
| Masscomp         | Concurrent Computer Corporation (formerly Masscomp) 7200C computer (with 12-bit digitizer) |
| K2               | Kinometrics Altus Series K2 (19-bit resolution field digitizer)                            |
| 72A-07           | Refraction Technology (REF TEK) model 72A-07 (24-bit field digitizer)                      |

| <b>Telemetry</b> | <b>Description</b>   |
|------------------|--|
| Analog           | Data transmission is analog along part of the transmission pathway |
| Digital          | Data are converted to digital form at the station site             |
| Hardwired        | Direct physical cable connection to computer recording system      |
| None             | On-site recording system   |

**Sponsor (or Operator for stations marked by \* in preceding columns)**

|        |  |
|--------|--|
| USGS   | U.S. Geological Survey                                   |
| Utah   | State of Utah  |
| ANSS   | Advanced National Seismic System                         |
| INEEL  | Idaho National Engineering and Environmental Laboratory  |
| USBR   | U.S. Bureau of Reclamation                               |
| LLNL   | Lawrence Livermore National Laboratory                   |
| Sandia | Sandia National Laboratory                               |
| BYU-I  | Brigham Young University, Idaho (formerly Ricks College) |

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