

# **Southern Appalachian Cooperative Seismic Network Center for Earthquake Research and Information The University of Memphis**

USGS Award No.: 1434-HQ-98-AG-01932

Annual Project Summary: 2001

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Program Element I.1

Key Words: Seismology, Mitigation, Real-time earthquake information, Database

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## **SUMMARY**

This is the annual project summary for USGS Award 1434-HQ-98-AG-01932: " *Collaborative Research: The University of Memphis, The University of North Carolina at Chapel Hill, and Virginia Tech: The Southern Appalachian Cooperative Seismic Network.*" This agreement covers the CERI component of the SACSNS to perform network operations, and routine data processing, archiving, and dissemination for the purpose of seismic hazards evaluation and scientific studies in the Southern Appalachian Seismic Zone. This report includes a review of station operations, technical challenges, data processing modifications. During the reporting period (October 1, 2000 through September 30 2001) the contract was in effect from October 1, 2000 through November 31, 2000. Thus, only the final two months of the project are reported.

CERI participates in two seismic networks, the Cooperative New Madrid Seismic Network (CNMSN) and the Southern Appalachian Cooperative Seismic Network (SACSNS). Economies of scale allow us to perform development that is applicable simultaneously to both networks, and would be otherwise difficult to support. For these reasons some sections below are identical between the two reports.

As of January 1, 1999, the SACSNS PI from Chapel Hill, Chris Powell, has assumed the duties of CERI Associate Director. This has facilitated cooperation to the extent that the previous two cooperating components of the SACSNS now operate as one network.

## **Routine Operations**

The SACSNS operated 20 permanent seismic stations for two months in FY 2001 (three new stations added in northeast TN). They are located in the eastern Tennessee and western North Carolina portions of the Southern Appalachian Seismic Zone (SASZ), and all but one are 3-component short-period stations. The sensors are 1 Hz L-4 or S-13 geophones attached to the gain-ranged PandaII electronics.

# **Southern Appalachian Cooperative Seismic Network Center for Earthquake Research and Information The University of Memphis**

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Telemetry concerns require geographically dividing this network into three subnetworks (the southern and eastern subnets are operational, the northern subnet is planned), each with its own autonomous central processing facility (referred to as remote nodes) where triggered data files are recorded digitally. One of the currently operating nodes is located on top of Star Mountain near Etowah, TN. Data are relayed to the Athens/McMinn county emergency management office where we have installed a PC that is connected to CERI via ISDN telephone. We have solved the telephone switching system problem and are now able to remotely connect to the system through ISDN dial-up. The call-oriented communications continues to be a significant impediment to routine maintenance and data analysis. We are investigating options for low-cost continuous connections. Another operational node is located at Lenoir-Rhyne College in Hickory, NC and has direct access to the internet. The bandwidth to this node continues to be unpredictable. A third new node was installed at Morristown Community College with direct public internet access to Memphis. The expected station is a CMG-3ESP/DM-24 located at the University of the South in Sewanee, TN (station SWET). Data from SWET are continuously received in near-real-time at Memphis using *earthworm* import/export modules.

A weekly summary of regional and worldwide earthquakes is faxed to approximately 100 recipients in the government and the private sector. While long-distance telephone charges for these faxes was not contained within the budget, the popularity of these reports has precluded other, less costly communications (e.g. internet). Data are also available via a [finger utility](#), and reviewed and automated [earthquake summaries](#) are also available for events within the past six months. Various [catalog searches](#) are also supported. [Pseudo-helicorder images](#) provide a quick review of station operation and events for the previous week.

### Data Acquisition System

Three remote acquisition systems and one local system in Memphis are maintained and provide several levels of redundancy. The remote systems are PC-based *earthworm* using National Instruments 12 bit digitizers. Standard short-to-long-term ratios are employed to store triggered data streams. Additionally, a revolving continuous buffer of about 3 days provides opportunities for post-event archiving. All remote nodes include about 3 days of battery backup. The node at CERI consists of 5 computers housed in an earthquake resistant rack within a halon protected, environmentally controlled room with battery and diesel generator backup. The Memphis systems are as follows:

- PC dedicated to digitizing.
- Sun Ultra 5 for local use and local stations only
  - redundant triggered data
  - redundant revolving continuous buffer
  - automated locations
  - automated alerts via page, email, recenteqs, QDDS, and experimental CUBE
- Sun Ultra 10 for external use and stations
  - triggered data
  - revolving continuous buffer
  - automated locations
  - automated alerts to external *earthworm* systems and experimental near-real-time database
  - near-real-time data exchange with other networks
- PC dedicated to experimental near-real-time *Oracle* database
- Sun Ultra 5 dedicated to www services.

Links to TVA via UT Knoxville were established during the reporting period however the stability of the UT Knoxville/Memphis link remains problematic. The following data were being exchanged as of 30 November, 2000:

- CHAS Charleston, SC (operated by USC)
  - export 19 channels to USC,
  - record local revolving buffer and triggered data streams
- COSC Columbia, SC (operated by USC)
  - import 19 channels from CHAS,
  - export 9 channels to LRNC,
  - export 5 channels to NEIC,
  - import triggered data from LRNC,
  - record local revolving buffer and triggered data streams
- BLA Blacksburg, VA (operated by VPI)
  - export 15 channels to LRNC,
  - export 5 channels to NEIC,
  - import 5 channels from LRNC,
  - import 5 channels from COSC,
  - import 6 channels from NEIC via LRNC
- LRNC Hickory, NC (operated by CERI)
  - import 9 channels from COSC,
  - import 15 channels from NEIC,
  - export 3 channels to NEIC,
  - export automated locations to CERI,
  - record local revolving buffer and triggered data streams, pending MTTN installation, will cease automated location and imports, and will export 28 channels to MTTN
- STAR Star Mountain near Athens, TN (operated by CERI)
  - record local revolving buffer and triggered data streams,
  - Pending internet access will export 32 channels to MTTN,
  - record local revolving buffer and triggered data streams
- MTTN Morristown, TN (operated by CERI)
  - export 12 channels to CERI,
  - record local revolving buffer and triggered data streams
- UT Knoxville, TN (operated by CERI)
  - export 20 channels to CERI,
  - import 20 channels from TVA,
  - import 21 channels from CERI,
  - export 21 channels to TVA,
  - record local revolving buffer
- TVA at Knoxville, TN (operated by TVA)
  - export 21 Channels to CERI via UT,
  - import 20 Channels from CERI via UT,
  - record local revolving buffer and triggered data streams

We are nearly complete with our collection and review of all CERI catalog information. We now have parametric and arrival information for nearly all events located by CERI staff from 1974 through 1999 in a consistent, reproducible format. This project required significantly more effort than anticipated and while our original intention was not to review these events at the arrival time level of detail, flaws encountered necessitated a detailed review. While there are still obstacles to making these data generally available (e.g. some events are stored in single quarterly files, others in single event files) we have upgraded the Oracle database to the v2 schema and will populate it with the 1974-present catalog. The previous un-edited archive containing parametric information from 1974-present and other information remains [available online](#). Waveform data are available on request via ftp for events recorded from 1996-present.