

## **Final Report**

### **MID-AMERICA INTEGRATED SEISMIC NETWORK - UKY**

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## EXECUTIVE SUMMARY

This project is part of the Mid-America Integrated Seismic Network (MAISN), a cooperative effort between the University of Memphis (CERI), St. Louis University, Virginia Tech, the University of South Carolina at Columbia, the University of Kentucky (UK), and the U.S. Geological Survey. The purposes of the MAISN are twofold:

1. To provide scientists, engineers, public and private entities, emergency responders, and the media with rapid and reliable information about felt and damaging earthquakes within a timeframe that maximizes the utility of the information.
2. To provide high quality data on a timely basis to the scientific and engineering communities for the purpose of improving:
  - a) seismic hazard estimation for urban population centers and the lifelines and critical facilities upon which they depend
  - b) estimation and measurement of strong ground motions
  - c) our understanding of the basic earthquake process and seismotectonics of earthquake zones, particularly in intraplate regions.

The University of Kentucky components of MAISN are:

1. To enhance operation and maintenance of the Kentucky Seismic and Strong Motion Network (KSSMN).
2. To enhance the data sharing with CERI, NEIC, and USGS NSMP in real-time and other methods.
3. To better provide earthquake information for all Kentuckian and other stake holders.

Currently, KSSMN consists of 19 short-period stations and 10 strong-motion stations. The short-period network includes 12 permanent and 7 temporary 1- and 3-channel stations (L-4C and L-28). The signals from the permanent seismic stations, BHKY, FLKY, FMKY, HEKY, LLKY, LOKY, MOKY, PAKY, PKKY, ROKY, SMKY, and SOKY, are transmitted to the University of Kentucky campus in Lexington, Kentucky through the Kentucky Emergency Warning System (KEWS) and digitized and recorded on a NetDAS 64 Channels System. The hilocoder displays of the 12 permanent seismic stations are generated by Earthworm and posed on <http://www.uky.edu/KGS/geologichazards/quake3.htm>. The waveforms from the 12 permanent stations are being delivered in real time to CERI and IRIS data center through the Earthworm mechanism.

UK operates a strong motion network of 10 stations in the remote area of central and northern New Madrid seismic zone and accessed through dia-up telephone lines. It is quite often that many of the strong-motion stations are not accessible due to poor quality of the phone-lines in the area. The unique feature of the network is the vertical strong-motion arrays that consist of one to two downhole accelerometers. The deepest borehole is 260 m (850 ft) below the surface at station VSAS in Fulton County, Ky. The vertical accelerometer array at VSAS consists of three three-component accelerometers, recorded on a 24-bit, 12-channel K2 digital recorder equipped with GPS timing. The deep accelerometer (FBA-23DH) is at the bottom of the hole. The second (ES-152DH) is at the bottom of a 30 m geotechnical hole. The third (Episensor) is a free-field installation placed on the surface. The vertical accelerometer array at VSAS is expanded. A 595 m (1,950 ft) borehole with 10 m penetration into bedrock was completed in November 2006. A workshop is planned to discuss the instrumentation and funding strategy for the borehole in 2007.

## INTRODUCTION

UK operates and maintains the Kentucky Seismic and Strong Motion Network (KSSMN). KSSMN was started with short-period stations in 1980's right after the 1980 Sharpsburg earthquake, and expanded to include strong motion stations in 1990's. The main funding for KSSMN is from the Commonwealth of Kentucky. The main purposes of KSSMN are:

1. To monitor earthquakes, mine blasts, and other activities in and around Kentucky.
2. To provide information on earthquakes and mine blasts for Kentuckian and other stake holders.
3. To better understand the basic earthquake process and seismotectonics in the region.
4. To better understand and characterize seismic hazards, the ground motion and site-effects in particular, in the New Madrid Seismic Zone.
5. To provide a real-time lab for education in seismology.

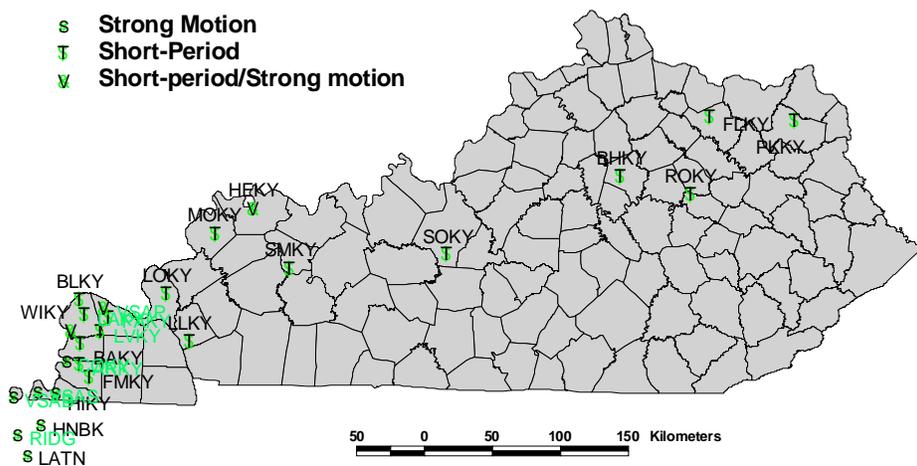
As a partner in the cooperative effort between the University of Memphis (CERI), St. Louis University, Virginia Tech, the University of South Carolina at Columbia, and the limited financial support from the U.S. Geological Survey, UK focuses on:

1. To enhance operation and maintenance of KSSMN.
2. To enhance the data sharing with CERI, NEIC, and USGS NSMP in real-time and other methods.
3. To better provide earthquake information for all Kentuckian and other stake holders.

The report will cover UK part of the cooperative effort between January 1, 2004 and December 31, 2006.

## KSSMN

Currently, UK operates and maintains 19 short-period stations and 10 strong-motion stations (Fig. 1). Between January 1, 2004 and December 31, 2006, two strong motion and three short-period stations were installed or restored with financial supports from the Commonwealth of Kentucky and the US Department of Energy with the Kentucky Research Consortium for Energy and Environment. The strong motion stations include the vertical strong motion arrays at VSAP and VSAS (Fig. 1). The short-period stations include HEKY, PAKY, and VSAP (Fig. 1). UK also pays the internet access for the real-time data transmitting from station MYKY (ANSS station) in Maysville, Ky., to CERI.



**Figure 1.** Kentucky Seismic and Strong Motion Network (KSSMN).

## DATA SHARING

UK has established and maintained real-time data sharing with CERI and IRIS data center through the Earthworm mechanism. The waveforms from the 12 short-period permanent stations, BHKY, FLKY, FMKY, HEKY, LLKY, LOKY, MOKY, PAKY, PKKY, ROKY, SMKY, and SOKY, are being delivered in real time. This real-time data sharing provide better and quicker locations and other parameters of earthquake occurring in Kentucky and its neighboring states. The hilocoder displays of the 12 short-period permanent seismic stations are generated by Earthworm and posed on <http://www.uky.edu/KGS/geologichazards/quake3.htm>.

Although the strong motion stations could not be accessed in real-time, UK had tried to share the strong motion data in a timely manner. For example, the data from the vertical strong motion arrays are useful for scientists and engineers. We have disseminated the data from the vertical strong motion arrays as soon as possible (Wang and others, 2004; Anderson and others, 2005; McIntyre and others, 2006; Wang and Woolery, 2006).

In order to better share the data, UK has updated hardware and software. UK also provided inputs for the regional and national networks and attended ANSS meetings and workshops.

## **EARTHQUAKE INFORMATION DISSEMINATION**

KSSMN provides timely information on earthquakes for all Kentuckian and others. The hilocoder displays of KSSMN at <http://www.uky.edu/KGS/geologichazards/quake3.htm> become one of the most popular website at UK. The website has been updated constantly to provide better information and services with links to the national and regional networks and earthquake information centers.

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