

Final Technical Report
USGS Cooperative Agreement for Geodetic Monitoring Operations

Reporting Period: March 2007-Feb 2010
Cooperative Agreement Number: 07HQAG0028
C.A. Start Date & End Date: 3/1/07 - 2/28/10
Geodetic Monitoring Project Name: GPS Array for Mid-America - monitoring
deformation in the New Madrid seismic zone
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Geodetic Project Web Site:

Major Goal(s) & Activities of the Geodetic Project:

[describe project goals and activities in general]

Continued operation of GPS Array for Mid America (this grant). Completed equipment and communications upgrade (from other funding sources).

Accomplishments & Changes Implemented in this Reporting Period:

[describe what accomplishments and changes have taken place in your operations since the start date of the current cooperative agreement—include new stations, new procedures, new partnerships, major tasks accomplished, etc]

Two new Continuous GPS stations (NMKM and LCHS) were installed in 2007-2008. The equipment for these sites was acquired with separate USGS funding. The total number of sites is now 13. A wireless network was built allowing the 4 sites in the Tiptonville, TN, area (RLAP, NWCC, NMKM and LCHS) to connect to the internet at the High School in Tiptonville, TN. Wireless internet communications were installed at two sites in the bootheel of Missouri (MAIR and STLE), and at a site in North Little Rock, Arkansas, CTJR. All sites now use the internet for communications and are downloaded by the UNAVCO Facility.

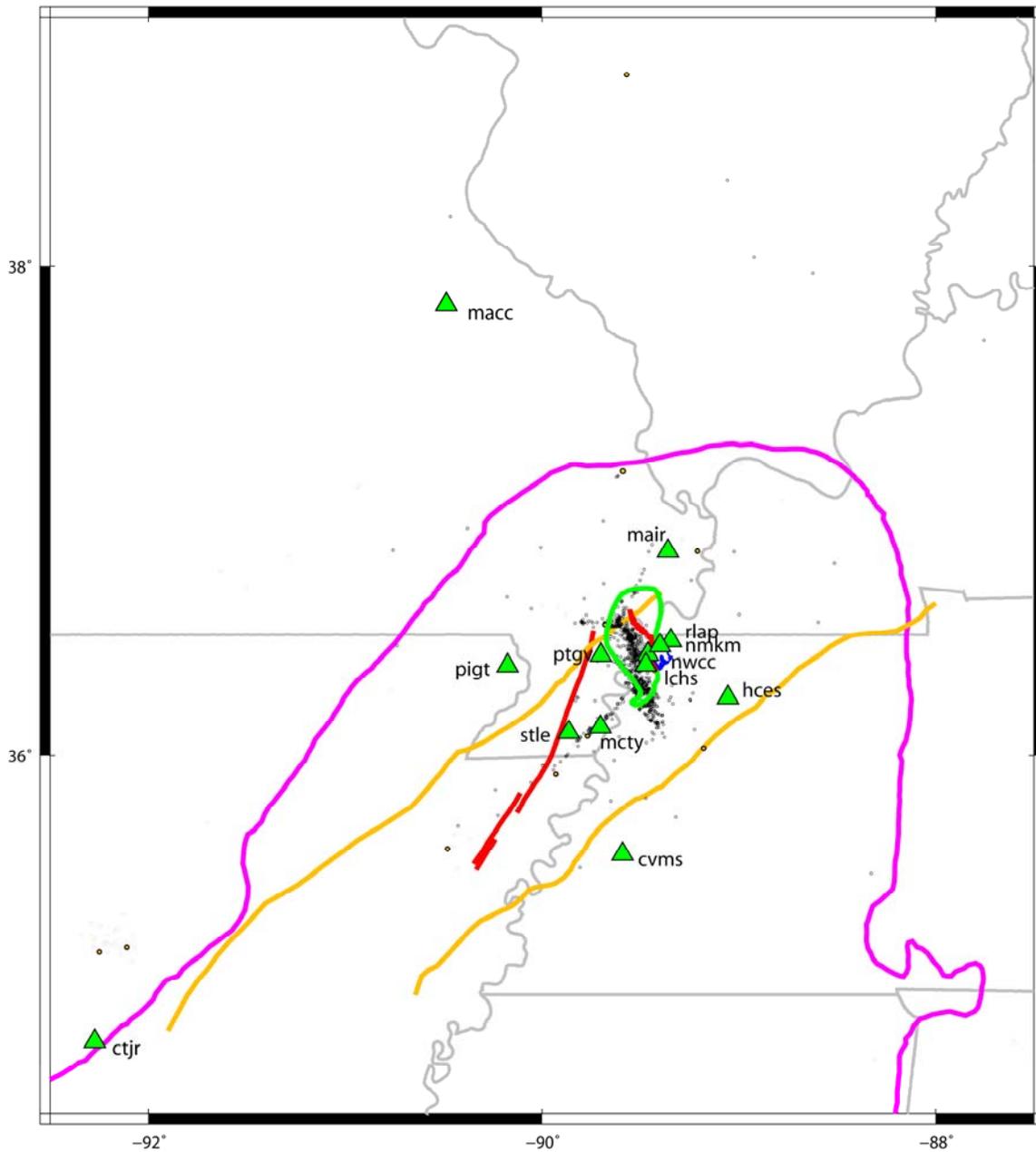
All sites are also programmed to collect data using the PBO settings.

Several sites were rebuilt and moved (the antennas/monuments did not change).

Figure 1 Map of Geodetic Stations:

[provide a page-width map of monitoring stations with site identifier and station location symbol—include a list of stations and the type of telemetry]

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Green triangles show continuous GPS stations. Red lines – inferred faults (Reelfoot and Bootheel); Green line – Lake County Uplift; Magenta – Mississippi Embayment; Orange – Reelfoot Rift boundaries. Small grey ($M < 3$), black ($3 < M < 4$) and orange circles ($M > 4$) show earthquakes of New Madrid Seismic Zone.

Table of current status of network

#	site name	rcvr type	comms	initial receiver acquisiton	upgrade receiver acquisition	monument acquisition	data collection rate
1	RLAP	NetRS	Upgraded to wireless internet communications	Z-12 USGS	NetRS NSF MAEC/CERI CS	CERI	15s/1s/5hz
2	NWCC	NetRS	Upgraded to wireless internet communications	Z-12 USGS	NetRS NSF MAEC/CERI CS	CERI	15s/1s/5hz
3	STLE	NetRS	internet, direct connect (wireless)	Z-12 NSF MAEC/CERI CS	micro-Z NSF MAEC/CERI CS; NetRS NSF MAEC/CERI CS	MAEC/CERI cost share	15s/1s/5hz
4	MCTY	NetRS	internet, direct connect	Z-12 NSF MAEC/CERI CS	NetRS NSF MAEC/CERI CS	MAEC/CERI cost share	15s/1s/5hz
5	PIGT	NetRS	internet, direct connect (wireless)	Z-12 NSF MAEC/CERI CS	micro-Z NSF MAEC/CERI CS; NetRS NSF MAEC/CERI CS	MAEC/CERI cost share	15s/1s/5hz
6	PTGV	NetRS	internet, direct connect (wireless)	Z-12 NSF MAEC/CERI CS	NetRS NSF MAEC/CERI CS	CERI	15s/1s/5hz
7	MAIR	NetRS	Upgraded to wireless internet communications	Z-12 USGS	micro-Z NSF MAEC/CERI CS; NetRS NSF MAEC/CERI CS	MAEC/CERI cost share	15s/1s/5hz
8	CTJR	NetRS	Upgraded to internet communications	Z-12 NSF MAEC/CERI CS		MAEC/CERI cost share	15s/1s/5hz
9	HCES	NetRS	internet direct connect, behind firewall	Z-12 NSF MAEC/CERI CS	NetRS NSF MAEC/CERI CS	MAEC/CERI cost share	15s/1s/5hz
10	CVMS	NetRS	internet direct connect, behind firewall	Z-12 NSF MAEC/CERI CS	micro-Z NSF MAEC/CERI CS; NetRS NSF MAEC/CERI CS	MAEC/CERI cost share	15s/1s/5hz
11	MACC	NetRS	internet, direct connect	Z-12 NSF MAEC/CERI CS	NetRS NSF MAEC/CERI CS	MAEC/CERI cost share	15s/1s/5hz
12	NMKM	NetRS	Upgraded to wireless internet communications	NetRS USGS-NEHRP		USGS-NEHRP	15s/1s/5hz
	CS		Cost Share				

The UNAVCO facility archives all 15 second data and downloads and archives 1 s and 5 hz data when PBO also downloads these.

Data Management Practices:

[describe project compliance with the USGS/EHP data management practices outlined in the 2007 Networks Announcement—the practices are listed at the end of this document; provide IGS site log forms, in txt or pdf, for each monitoring station]

15 second data for all stations with internet communications is collected by both CERl and the UNAVCO Facility Archive in Boulder, CO, where it is placed online immediately in RINEX format.

CERl downloads and archives the continuous 1 second data.

The UNAVCO Facility downloads and archives 1 second and 5 Hz data whenever it does the same for PBO.

Lack of bandwidth and support for archiving/distributing prevent regular downloading of the 5 Hz on a regular basis.

The data are being routinely processed at CERl and by the PBO processing facility.

Continuity of Operations and Response Planning:

[describe briefly plans to respond to major earthquakes, including cooperative arrangements with others and plans to cope with power and communication failures]

Each site has back up power for approximately 2 weeks (one site is solar powered and does not depend on the grid for power). The receivers have sufficient memory to continue to record data during the time period during which backup power is being used.

Sites that use the regular internet depend on it for their communications and will require site visits if the internet goes down.

Problems or Concerns Encountered

[describe any problems or concerns related to the project and actions or plans to address them]

The original GPS network was dependent on telephone communications and access to telephone and power controlled final site selection. Internet

and wireless communications provide a different set of constraints for final site selection. We found it was not practical to expand the CERI microwave network to the area around Tiptonville, TN, as it required a very high radio tower. The problem of providing communications for the four stations in the Tiptonville area was solved by building a local wireless network that connects to the internet at the local high school.

We have been having problems with the flash cards on the Trimble NetRS receivers. Several have or are currently being repaired at the UNAVCO Facility. This may be due to write cycle limits of the flash cards (a known issue). We have recently acquired two new receivers (Trimble NetR8) for use as spares, acquired with non-USGS funds, which has allowed us to maintain operation of the full network.

Other Information and Comments:

[provide additional information, comments, diagrams, photographs, etc that may be helpful to USGS in evaluating your progress during the reporting period for optional year funding]

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USGS/EHP Data Management Practices for Geodetic Monitoring Operations:

- For the operation of CGPS, the network operators will maintain the instrumentation, telemetry, and provide the raw, 120-second or better data in RINEX format (or other format such as SOC or DBEN if a mutually agreed-to specification is accepted by USGS and partner data users and if the data format is fully and openly described.) Data is to be available for download by anyone through the UNAVCO GPS Seamless Archive. The network operator will process the data such that solutions are readily incorporated into PBO daily data products.
- For the operation of strainmeter and creepmeter instruments, the USGS requires that the network operator maintain the instrumentation at the site, and provide computer files (plots alone are not acceptable) of clean, processed data in geophysically meaningful units over the Web with a nominal latency of not more than six months.
- For both the borehole strainmeter and creepmeter instruments, raw data must be available in near real time for internal use by the USGS to assist with hazards assessments (these data are currently provided via the GOES telemetry.)
- For creepmeters, borehole strainmeters, and long-base strainmeters, data must be archived with the Northern California Earthquake Data Center (NCEDC) in NCEDC standard format.
- For alignment arrays the network operator will measure existing sites in northern California at approximately one year intervals unless it is agreed, in consultation with USGS personnel, that measurements should be made more or less frequently. Plots of time-series data shall be updated and made available to USGS annually, and tables or computer files of those time series shall be included in the Final Report and released in a publicly available form at the end of the final year of the agreement.

