Final Technical Report

Cooperative Agreement Number: G10AC00160

USGS Cooperative Agreement for Geodetic Monitoring Operations

Geodetic Monitoring Project Name:
GPS Array for Mid-America Monitoring Deformation in the New Madrid seismic zone

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Reporting Period: March 2010 through February 2015
C.A. Start Date & End Date: March 2010 through February 2015

Abstract:

The GPS Array for Mid-America (GAMA) is a Continuous GPS (CGPS) network focused on monitoring crustal deformation associated with the New Madrid seismic zone (NMSZ). It is also the only CGPS network in the central United States with stable geodetic monuments. It samples the crust in the NMSZ sparsely at three scales: Fault, crustal and regional. Since its inception in 1998 under the NSF funded Mid-American Earthquake Center, and its continued operation and maintenance since 2007 under the NEHRP USGS Cooperative Agreement for Geodetic Monitoring Operations GAMA has provided open, unrestricted access to the GPS data, and has been used by several scientific groups to address crustal deformation and seismic hazard in the region.

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

[describe project goals and activities in general]

Goals: Continued operation (this grant) of the GPS Array for Mid-America (GAMA), maintain network size (as funds allow for replacement of GPS receivers or antennas if/as they fail, replacement receivers would also be upgrades, depending on unit that failed).

Activities: continued operation, maintenance (and upgrade when old equipment fails). All GAMA sites are now using Internet for receiver control and data transfer, all sites in the state of Tennessee also contribute to Tennessee Department of Transportation (TODT) real time network.

Accomplishments & Changes Implemented in this Reporting Period:

[describe what accomplishments and changes have taken place in your operations for the reporting period—include new stations, new procedures, new partnerships, major objectives accomplished, etc]

Upgraded 6 of the stations to Trimble NetR9's, one to an R8 and still have 8 NetRS's in operation. One NetR8 failed due to lightning on the antenna line (this seems like a very close strike as it blew up everything) and one NetR9 failed due to lightning surge on the Ethernet connection. All stations have been hardened (added lightning arrestors on the antennas, the boxes already had them) and added either lightning protection on the Ethernet connection or installed fiber. Lost a number of NetRS's due to age. (in total acquired 2 NetR8 and 7 NetR9 receivers, to replace NetRSs as they died, loosing one of each to lightning)

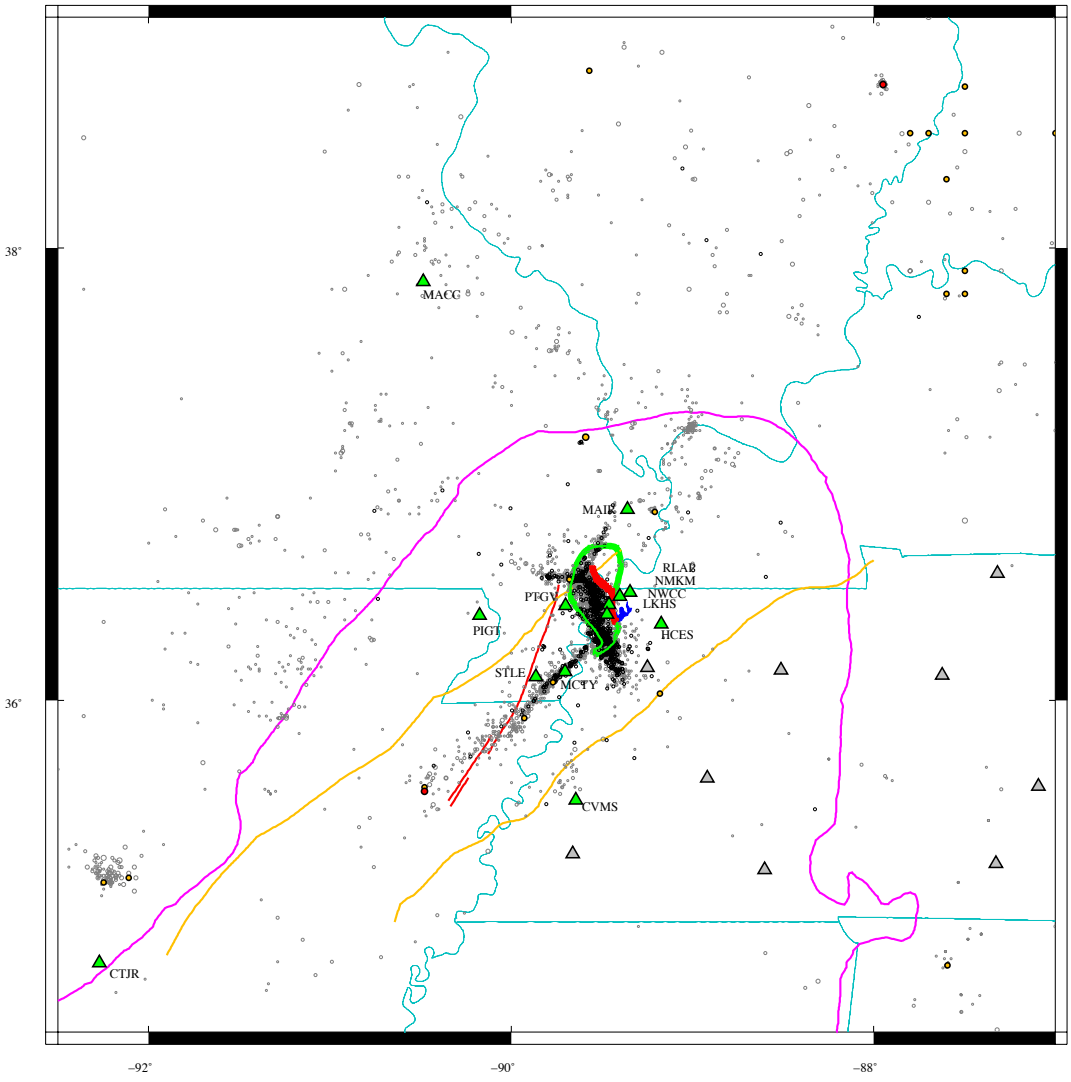
We had to move several receiver/equipment boxes due to changes in host environment, and built protection around several sites (to protect from people and farm equipment).

There were no new stations installed. Downloading is now done automatically to the UNAVCO Facility Archive. High rate downloads are done by CERI, with local archiving. TDOT receives 1 Hz data in real time, and it is available from TDOT (but is not free).

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]

No change in configuration during the reporting period.


38°
36°
−92°
−90°
−88°
MACG
MAIB
RLAB
NMKM
NWCC
LKHS
PFGV
PIGT
HCES
STLE
MCTY
CVMS
CTJR

Metadata for GPS Stations

[provide any updated information since your Metadata Report submittal about each USGS-supported station, as illustrated by the example in the template]

Site/monument information for GPS stations:

Site name	code	site type	Monument	Install date
Reelfoot Lake State Park	RLAP	C- GPS	I-Beam	10/15/97
Northwest Corrections Center	NWCC	C- GPS	I-Beam	07/11/00
Steele Airport	STLE	C- GPS	I-Beam	04/27/00
McCarty R-3 School	MCTY	C- GPS	I-Beam	04/21/00
Piggot water treatment plant	PIGT	C- GPS	I-Beam	02/26/00
Delta Research Center, Portageville	PTGV	C- GPS (collocated with PTMO broadband seismic station)	I-Beam	03/11/99
Mississippi County Airport	MAIR	C- GPS PS	I-Beam	02/26/00
Camp JT Robinson	CJTR	C- GPS	Steel mast in rock	09/15/99
Hill Crest Elementary School	HCES	C- GPS	I-Beam	08/17/00
Covington Middle School	CVMS	C- GPS	I-Beam	06/22/00
Mineral Area College	MACC	C- GPS	Steel mast in rock	10/13/99
New Markham	NMKM	C- GPS	DBM	01/09/08
Lake County High School	LCHS	C- GPS	DBM	01/09/08

Site location information for GPS stations:

City	County	St	X (m)	Y (m)	Z (m)	Lat (N)	Lon (E)	Elev (m)
Tiptonville	Lake	TN	58663.96	-5134604.22	3770669.30	36.474	-89.345	58.47
Tiptonville	Lake	TN	48583.29	-5138518.71	3765529.06	36.417	-89.458	64.92
Steele	Pemiscot	MO	12827.29	-5160199.99	3736229.95	35.906	-89.857	50.44
McCarty	Pemiscot	MO	26808.67	-5158166.70	3738951.17	36.119	-89.702	51.61
Piggott	Clay	AR	-15723.78	-5141765.76	3761385.19	36.370	-90.175	55.32
Portageville	New Madrid	MO	26938.23	-5138875.51	3765245.17	36.413	-89.700	58.09
Charleston	Mississippi	MO	57369.54	-5109959.40	3803820.24	36.847	-89.357	67.52
North Little Rock	Pulaski	AR	-207900.95	-5237733.64	3621714.98	34.822	-92.273	126.07
Troy	Obion	TN	74358.65	-5143751.66	3758031.33	36.333	-89.172	77.99
Covington	Tipton	TN	32327.59	-5195705.17	3686948.89	35.451	-89.644	73.01
Park Hills	St. Francois	MO	-42649.83	-5042996.72	3892013.17	37.845	-90.485	220.06
Tiptonville	Lake	TN	53749.88	-5135969.69	3768904.29	36.271	-89.400	58.00
Tiptonville	Lake	TN	47367.49	-5141175.77	3761937.64	36.193	-89.472	62.00

Instrument information for GPS stations, one line with date for each equipment change:
Summary of changes – update NetRS receivers to final version of firmware 1.3-1. Replace several receivers that failed

Date	What	Code	Receiver type	Receiver S/N	FW	Antenna type	Antenna S/N	Antenna Height, m
06/01/2000	Install	CVMS	Z-12	LP03440		ASH700936D_M w/ Snow Dome	CR520000405	0
7/16/2003	Change receiver	CVMS	Micro-Z	ZR220022401		ASH700936D_M w/ Snow Dome	CR520000405	0
1/23/2004	Change receiver	CVMS	Micro-Z	UC200316025				0
6/22/2006	Change receiver	CVMS	Micro-Z	ZR220022413				0
1/13/2007	Change receiver	CVMS	Micro-Z	ZR220022401				0
1/27/2007	Update FW	CVMS	Micro-Z	ZR220022401	CK00			
3/2/2007	Change receiver	CVMS	NetRS	4646125547				
6/26/2007	Change Radome	CVMS				ASH700936D_M Radome SCIS 0412	CR520000405	0
05/17/2010	Change receiver	CVMS	NetR8	5013K66509	4.14			
09/18/2010	Update FW	CVMS	NetR8	5013K66509	4.17			
10/17/2010	Change Receiver	CVMS	NetR8	5010K66014	4.17			
2/28/2011	Update FW	CVMS	NetR8	5010K66014	4.19			
5/26/2011	Update FW	CVMS	NetR8	5010K66014	4.41			
8/03/2012	Change receiver	CVMS	NetR9	5044K71324	4.60			
2/25/2014	Change antenna, same radome	CVMS				PN - 701945-01 Rev B ASH701945B_M Radome SCIS 0412	CR519991709	
2/25/2014	Update FW	CVMS	NetR9	5044K71324	4.62			
3/31/2015	Update FW	CVMS	NetR9	5044K71324	4.70			
8/1/1999	Install	CRAR	Z-12	LP01664		ASH700936D_M w/ Snow Dome	CR16943	0
2/13/2004	Rename CRAR to CJTR	CJTR	Z-12	LP01664		ASH700936D_M w/ Snow Dome	CR16943	0

3/14/2007	Change receiver	CJTR	NetRS	4644124587	1.1-5			
12/10/2007	Change Radome	CJTR				ASH700936D_M SCIS Radome 0428	CR16943	
11/30/2009	Internet comms established	CJTR	NetRS	4644124587	1.1-5			
5/10/2011	Update FW	CJTR	NetRS	4644124587	1.3-1			
7/16/2015	New receiver and antenna	CJTR	NetR9	5349K48409	4.93	ASH701945D_M SCIS Radome 0428		
08/17/2000	Install	HCES	Z-12	LP00493		ASH700936D_M w/ Snow Dome	CR520002502	0
6/13/2002	Change receiver	HCES	Z-12	LP019992705				0
2/4/2005	Change receiver	HCES	NetRS	4427235630	1.0-3			0
5/18/2005	Change receiver	HCES	NetRS	4431236751	1.1-2			0
6/21/2005	Update FW	HCES	NetRS		1.1-3			0
6/29/2005	Change receiver	HCES	NetRS	4429236312	1.1-2			
7/7/2005	Replace radome	HCES				ASH700936D_M Replaced SNOW radome	CR520002502	0
3/20/2006	Update FW	HCES	NetRS	4429236312	1.1-5			
6/11/2007	Change Radome	HCES				ASH700936D_M SCIS Radome 0303	CR520002502	0
7/5/2009	Change receiver	HCES	NetRS	4632120758	1.1-5			
5/8/2011	Update FW	HCES	NetRS	4632120758	1.3-1			
2/16/2012	Change receiver	HCES	NetR9	5044K71324	4.43			
4/11/2012	Change receiver	HCES	NetRS	4632120758	1.3-1			
1/10/2008	Install	LCHS	NetRS	4431236763	1.1-5	ASH700936D_M	CR520002501	0.075
4/29/2011	Update FW	LCHS	NetRS	4431236763	1.3-1			
2/16/2012	Change receiver	LCHS	NetR9	5112K74584	4.43			
4/24/2015	Update firmware	LCHS	NetR9	5112K74584	4.70			
10/13/1999	Install	MACC	Z-12	LP019992705	CD00	ASH700936D_M w/ Snow Dome	11755	0
7/25/2001	Change receiver	MACC	Z-12	LP01766	CD00	ASH700936D_M	CR520000601	0
3/30/2005	Change receiver	MACC	NetRS	4427235628	1.1-1			
5/19/2005	Change receiver	MACC	NetRS	4427235647	1.1-1			

6/22/2005	Change receiver	MACC	NetRS	4427235647	1.1-3			
6/30/2005	Update FW	MACC	NetRS	4427235647	1.1-2			
3/20/2006	Update FW	MACC	NetRS	4427235647	1.1-5			
7/13/2007	Change Radome	MACC				ASH700936D_M Radome SCIS 0429	CR520000601	0
11/24/2008	Change receiver	MACC	NetRS	4646125551	1.1-5			
4/29/2011	Update FW	MACC	NetRS	4646125551	1.3-1			
7/15/2011	Change Antenna	MACC				ASH700936D_M Radome SCIS 0429	CR520000401	0
9/5/2012	Change LNA in antenna, no change to antenna serial number. No serial number on LNA.	MACC					CR520000401	0
3/25/2015	Changed receiver and antenna	MACC	NetR9	5347K47846	4.81	TRM57971.00 No radome	5000112538	
3/31/2015	FW update	MACC	NetR9	5347K47846	4.93			
2/1/2000	Install	MAIR	Z-12	LP03379	CC00	ASH700936D_M w/ Snow Dome	CR520000408	0
5/5/2004	Change receiver	MAIR	Z-12	LP00491				
6/2/2004	Change receiver	MAIR	Z-12	LP03371				
8/31/2004	Change receiver	MAIR	Z-12	LP0379				
2/10/2006	Change receiver	MAIR	Micro-Z	ZR220022401				
9/09/2006	Change receiver	MAIR	NetRS	4612261949	1.1-5			
6/4/2007	Change Radome	MAIR				ASH700936D_M Radome SCIS 0418	CR520000408	0
06/16/2008	Wireless comms installed	MAIR	NetRS	4612261949	1.1-5			
5/10/2011	Update FW	MAIR	NetRS	4612261949	1.3-1			
9/4/2012	Change receiver	MAIR	NetR9	5206K82035	4.61			
3/31/2015	Firmware update	MAIR	NetR9	5206K82035	4.85			
3/1/2000	Install	MCTY	Z-12	LP03376		ASH700936D_M w/ Snow Dome	11782	0
2/3/2005	Change receiver	MCTY	NetRS	4435237654	1.0-3			
5/18/2005	Change receiver	MCTY	NetRS	4435237668	1.1-2			

6/22/2005	Update FW	MCTY	NetRS	4435237668	1.1-3			
6/29/2005	Change receiver	MCTY	NetRS	4435237654	1.1-2			
8/8/2005	Change receiver	MCTY	NetRS	4427235628	1.1-2			
3/20/2006	Update FW	MCTY	NetRS	4427235628	1.1-5			
6/12/2007	Change Radome	MCTY				ASH700936D_M Radome SCIS 0423	11782	
12/11/2007	Change receiver	MCTY	NetRS	4646125551	1.1-5			
9/28/2008	Change receiver	MCTY	NetRS	4427235628	1.1-5			
6/6/2009	Change receiver	MCTY	NetRS	4644124586	1.1-5			
10/01/2010	Update FW	MCTY	NetRS	4644124586	1.3-0			
3/3/2011	Change receiver	MCTY	NetR8	5013K66509	4.19			
5/7/2011	Update FW	MCTY	NetR8	5013K66509	4.41			
10/24/2013	Change Receiver	MCTY	NetR9	5238K52489	4.46			
2/14/2014	Change receiver and antenna	MCTY	NetR9	5302K56776	4.62	ASH700936D_M SCIS Radome 0423		
3/30/2015	Update firmware	MCTY	NetR9	5302K56776	4.93			
1/10/2008	Install	NMKM	NetRS	4718131954	1.1-5	ASH701945C_M Radome SCIS 0460	CR620013601	0.075
5/26/2009	Change receiver	NMKM	NetRS	4427235647	1.1-5			
5/8/2011	Update FW	NMKM	NetRS	4427235647	1.3-1			
10/5/2012	Change receiver	NMKM	NetRS	4431236763	1.3-1			
07/11/2000	Install	NWCC	Z-12	LP03375	CD00	ASH700936D_M w/ Snow Dome	CR520000573	0
09/07/2000	Change receiver	NWCC	Z-12	LP01776		PN-701945-01 Rev C, ASH700936C_M w/ Snow Dome	CR520000503	0
7/20/2001	Change receiver	NWCC	Z-12	LP03371				
5/15/2004	Change receiver	NWCC	Z-12	LP00463				
6/20/2005	Change receiver	NWCC	Z-12	LP01766				
3/7/2007	Change receiver	NWCC	NetRS	4646125548	1.1-5			
6/5/2007	Change Radome	NWCC				PN-701945-01	CR520000503	0

						Rev C, ASH700936C_M Radome SCIS 0420		
04/23/2007	Internet comms established	NWCC	NetRS	4646125548	1.1-5			
5/9/2011	Update FW	NWCC	NetRS	4646125548	1.3-1			
2/11/2015	Replace antenna	NWCC				TRM57971.00 No Radome	1441009473	
2/1/2000	Install	PIGT	Z-12	LP00491	CD00	ASH700936D_M w/ Snow Dome	CR520000401	0
10/15/2003	Change receiver	PIGT	Z-12	LP03375	CD00	ASH700936D_M	CR520000404	0
2/24/2006	Change receiver	PIGT	Micro-Z	UC1200316023	CN00			
12/1/2006	Change receiver Internet comms established	PIGT	NetRS	4427235630	1.1-5			
7/13/2007	Change Radome	PIGT				ASH700936D_M Radome SCIS 0410	CR520000404	0
10/18/2010	Change receiver	PIGT	NetRS	4646125547	1.3-0			
5/20/2011	Update FW	PIGT	NetRS	4429236312	1.3-1			
11/29/2012	Change receiver	PIGT	NetR8	5010K66014	4.48			
1/29/2015	Change antenna	PIGT				ASH700936D_M Radome SCIS 0410	CR1991783	
3/1/1999	Install	PTGV	Z-12	LP00491		ASH700936D_M w/ Snow Dome	11767	0
8/7/1999	Update FW	PTGV	Z-12	LP00491	CC00			
1/12/2000	Change receiver	PTGV	Z-12	LP03423				
5/13/2002	Change receiver	PTGV	Z-12	LP03429				
12/20/2004	Change receiver	PTGV	NetRS	4427235628	1.0-3			
5/19/2005	Change receiver	PTGV	NetRS	4424234797	1.0-3			
6/22/2005	Update FW	PTGV	NetRS	4424234797	1.1-3			
6/30/2005	Update FW	PTGV	NetRS	4424234797	1.1-2			
1/11/2006	RMA	PTGV	NetRS	4424234797	1.1-3			

4/3/2006	Update FW	PTGV	NetRS	4424234797	1.1-5			
6/12/2007	Change Radome	PTGV				ASH700936D_M Radome SCIS 0407	11767	0
08/20/2010	Update FW	PTGV	NetRS	4424234797	1.2-0			
5/20/2011	Update FW	PTGV	NetRS	4646125547	1.3-1			
3/15/1997	Install	RLAP	Z-12	LP00493	CC00	ASH700936D_M w/ Snow Dome	11762	0
6/16/2000	Change receiver	RLAP	Z-12	LP03441	CD00			
7/21/2001	Change receiver	RLAP	Z-12	LP03375	CD00	ASH700936D_M w/ Snow Dome	CR52002501	0
10/2/2003	Change receiver	RLAP	Z-12	LP03440		ASH700936D_M w/ Snow Dome	CR520000401	0
5/17/2005	Change receiver	RLAP	NetRS	4427235680				
6/8/2005	Solar conversion	RLAP	NetRS	4427235680				
6/21/2005	Change receiver	RLAP	NetRS	4427235630	1.1-3			
6/30/2005	Update FW	RLAP	NetRS	4427235630	1.1-2			
4/3/2006	Update FW	RLAP	NetRS	4427235630	1.1-5			
9/15/2006	Change receiver	RLAP	NetRS	4632120758	1.1-5			
6/5/2007	Change Radome	RLAP				ASH700936D_M Radome SCIS 0411	CR520000401	0
4/28/2009	Change receiver	RLAP	NetRS	4427235647	1.1-5			
5/26/2009	Change receiver	RLAP	NetRS	4718131954	1.1-5			
8/9/2009	Change antenna	RLAP				ASH701945E_M Radome SCIS 0411	CR520022108	
5/8/2011	Update FW	RLAP	NetRS	4718131954	1.3-1			
3/1/2000	Install	STLE	Z-12	LP03369		ASH700936D_M w/ Snow Dome	CR520000402	0
9/10/2006	Change receiver	STLE	NetRS	4611206678	1.1-5			
6/5/2007	Change Radome	STLE				ASH700936D_M Radome SCIS 0402	CR520000402	0
09/19/2007	Wireless comms installed	STLE	NetRS	4611206678	1.1-5			

5/10/2011	Update FW	STLE	NetRS	4611206678	1.3-1			
9/4/2012 4/3/2015	Change receiver Update firmware	STLE STLE	NetR9 NetR9	5207K82122 5207K82122	4.61 4.85			

Sources of funding for acquisition of the GAMA GPS equipment and monuments. The original 11 sites (all sites except NMKM and LCHS) were sited to have no-cost access to telephone service and CERI covered the acquisition and upgrade to Internet service for these sites.

#	code	Initial receiver acquisition	Upgrade receiver/comms acquisition	Monument acquisition
1	RLAP	Z-12 USGS	NetRS NSF MAEC/CERICS; Freewave2Internet CERI	CERI
2	NWCC	Z-12 USGS	NetRS NSF MAEC/CERICS; Freewave2Internet CERI	CERI
3	STLE	Z-12 NSF MAEC/CERICS	1) micro-Z NSF MAEC/CERICS then 2) NetRS NSF MAEC/CERICS; Freewave2Internet CERI	MAEC/CERICS
4	MCTY	Z-12 NSF MAEC/CERICS	1) NetRS NSF MAEC/CERICS 2) NetR8 USGS (budget revision to acquire spare/CERI) 3) NetR9 USGS (budget revision to acquire spare/CERI) 4) NetR9 USGS (budget revision to acquire spare/CERI)	MAEC/CERICS
5	PIGT	Z-12 NSF MAEC/CERICS	1) micro-Z NSF MAEC/CERICS then 2) NetRS NSF MAEC/CERICS	MAEC/CERICS
6	PTGV	Z-12 NSF MAEC/CERICS	NetRS NSF MAEC/CERICS; wireless2Internet CERI	CERI
7	MAIR	Z-12 NSF MAEC/CERICS	1) micro-Z NSF MAEC/CERICS then 2) NetRS NSF MAEC/CERICS; wireless2Internet CERI	MAEC/CERI cost share
8	CTJR	Z-12 NSF MAEC/CERICS	NetRS NSF MAEC/CERICS	MAEC/CERI cost share
9	HCES	Z-12 NSF MAEC/CERICS	NetRS NSF MAEC/CERICS; wireless2Internet CERI	MAEC/CERI cost share
10	CVMS	Z-12 NSF MAEC/CERICS	1) micro-Z NSF MAEC/CERICS then 2) NetRS NSF MAEC/CERICS 3) NetR8 USGS (budget revision to acquire spare)/CERI; fiber2Internet CERI	MAEC/CERI cost share
11	MACC	Z-12 NSF MAEC/CERICS	NetRS NSF MAEC/CERICS	MAEC/CERI cost share
12	NMKM	NetRS USGS-NEHRP	Freewave2Internet CERI	USGS-NEHRP
13	LCHS	NetRS USGS-NEHRP	FreewaveBaseStation2Internet CERI	USGS-NEHRP
14	CVMS	NetR8 USGS-NEHRP		
15	MCTY	NetR8 USGS-NEHRP		
16	CVMS	NetR9 USGS-NEHRP		
17	CTJR	NetR9 USGS-NEHRP		
18	HCES	NetR9 USGS-NEHRP		
19	MACC	NetR9 USGS-NEHRP		
20	MAIR	NetR9 USGS-NEHRP		
21	MCTY	NetR9 USGS-NEHRP		

CERICS = CERI Cost Share as part of the grant.
CERI = CERI funded, independent of /in addition to Cost Sharing on the grant.

Telemetry information:

Code	Telemetry	Sample interval sec/sec or Hz/Hz	Real time stream available?
RLAP	FSSWI to Lake Co. H.S.	15/1/5	Yes/TDOT
NWCC	FSSWI to Lake Co. H.S.	15/1/5	Yes/TDOT
STLE	FSSWI to internet through Steele School Administration	15/1/5	Yes/TDOT
MCTY	DCI at Pemiscot R-3 school, downloaded by UFA	15/1/5	Yes/TDOT
PIGT	DCI through donated service (wireless)	15/1/5	no
PTGV	WDCI through Delta Research Center/U. Missouri	15/1/5	Yes/TDOT
MAIR	WDCI donated by local business.	15/1/5	no
CJTR	DCI behind firewall/virtual network AR National Guard	15/1/5	no
HCES	DCI behind firewall at Public Hillcrest Elementary School	15/1/5	Yes/TDOT
CVMS	DCI behind firewall at Public Crestview Middle School	15/1/5	Yes/TDOT
MACC	DCI at Mineral Area Community College	15/1/5	no
NMKM	FSSWI to Lake Co. H.S.	15/1/5	Yes/TDOT
LCHS	DCI through Lake Co. H.S.	15/1/5	Yes/TDOT

(Note: TDOT = Tennessee Department of Transportation. TDOT charges organizations that do not contribute real-time GPS data to the network for access to the real-time stream.)

Data Management Practices:

[See attached **USGS/EHP Data Management Practices for Geodetic Monitoring Operations**; describe project compliance with the USGS/EHP data management practices outlined in your 2010-14 Networks Cooperative Agreement—the practices are listed at the end of this document; provide IGS site log forms, in txt or pdf, for each monitoring station]

The 15-second data for all stations are downloaded by both CERI and the UNAVCO Facility Archive (UFA) in Boulder, CO, on a daily baiss. The UFA places them on the UFA server for open access.

CERI downloads and archives the 15 sec and 1 second data.

The UFA 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 downloading of the 5 Hz data on a regular basis.

IGS logs are maintained by the UNAVCO Facility Archive and are available through the archive DAI or directly at

ftp://data-out.unavco.org/pub/logs/***xxxx***log.txt

where ***xxxx*** is replaced by the 4 character station code.

Time Series

GAMA processing changed from CERI processing to PBO (under a subcontract through the UNAVCO Facility for $1/day/station+overhead) in 2012. The time series since 2012 are available from PBO. In 2015 the processing again changed, this time going to the USGS and the time series is available from the USGS.

Additionally a long time series of GAMA data can be found at

http://geodesy.unr.edu/billhammond/gpsnetmap/GPSNetMap.html

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 Internet for their communications and will require site visits if the Internet goes down.

An event that is large enough to interrupt Internet service will also affect the seismic networks and trigger an aftershock seismic response. Downloading and maintenance of the GPS receivers will be incorporated into the seismic fieldwork.

Problems or Concerns Encountered

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

We are continuing to have problems with the flash cards or outright failure of the Trimble NetRS receivers. The issue with the flash cards is due to write cycle limits of the flash cards (a known issue).

We are acquiring new receivers (Trimble NetR9) as we are able to replace receivers that fail, which will allow us to maintain operation of the full network. Trimble has terminated the always open acquisition plan that was available to UNAVCO members and returned to the 3 month window in which more than 50 units have to be ordered by Educational Institutions (not limited to UNAVCO members). Trimble will not confirm when and for how long the windows will be open. The UNAVCO Facility has chosen a new standard receiver. The specifications and price of the new receiver are not yet public. We have one NetRS at the UNAVCO Faciliity for possible repair (we do not know if it is repairable), if not we have not spare receivers.

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]

September 2009

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 shall be available for download by anyone through the UNAVCO GPS Seamless Archive. The network operator shall process the data such that solutions are readily incorporated into PBO daily data products.

RINEX data files from the GAMA network are available from the UNAVCO GPS Seamless Archive.

Time series data (position and velocity) are available from the USGS.

Geodetic Project Web Site: http://www.ceri.memphis.edu/~gps/
With links to metadata, RINEX data, maps, positions, velocities, and quality control.

RINEX data (15 sec epochs) is available from
http://facility.unavco.org/data/gnss/perm_sta.php
filter by network, using network code GAMA.

Time series and velocities available from
http://earthquake.usgs.gov/monitoring/gps/

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Publications using GAMA network data

By PIs

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O.S. Boyd, Y. Zeng, L.R. Guzman, R. Smalley, Do small surface strains in the New Madrid seismic zone reflect a physical process? Abstract, G43C-01, presented at 2011 Fall Meeting, AGU, San Francisco, Calif. 5-9 Dec, 2011.

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Thesis

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Known Publications using GAMA network data by authors other than the PIs

Craig, T. J., and E. Calais (2014), Strain accumulation in the New Madrid and Wabash Valley seismic zones from 14 years of continuous GPS observation, J. Geophys. Res. Solid Earth, 119, 9110–9129, doi:10.1002/2014JB011498.